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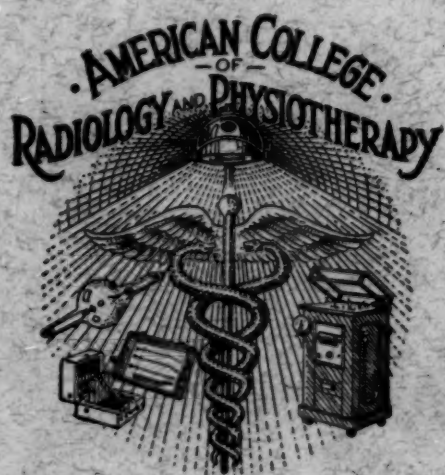
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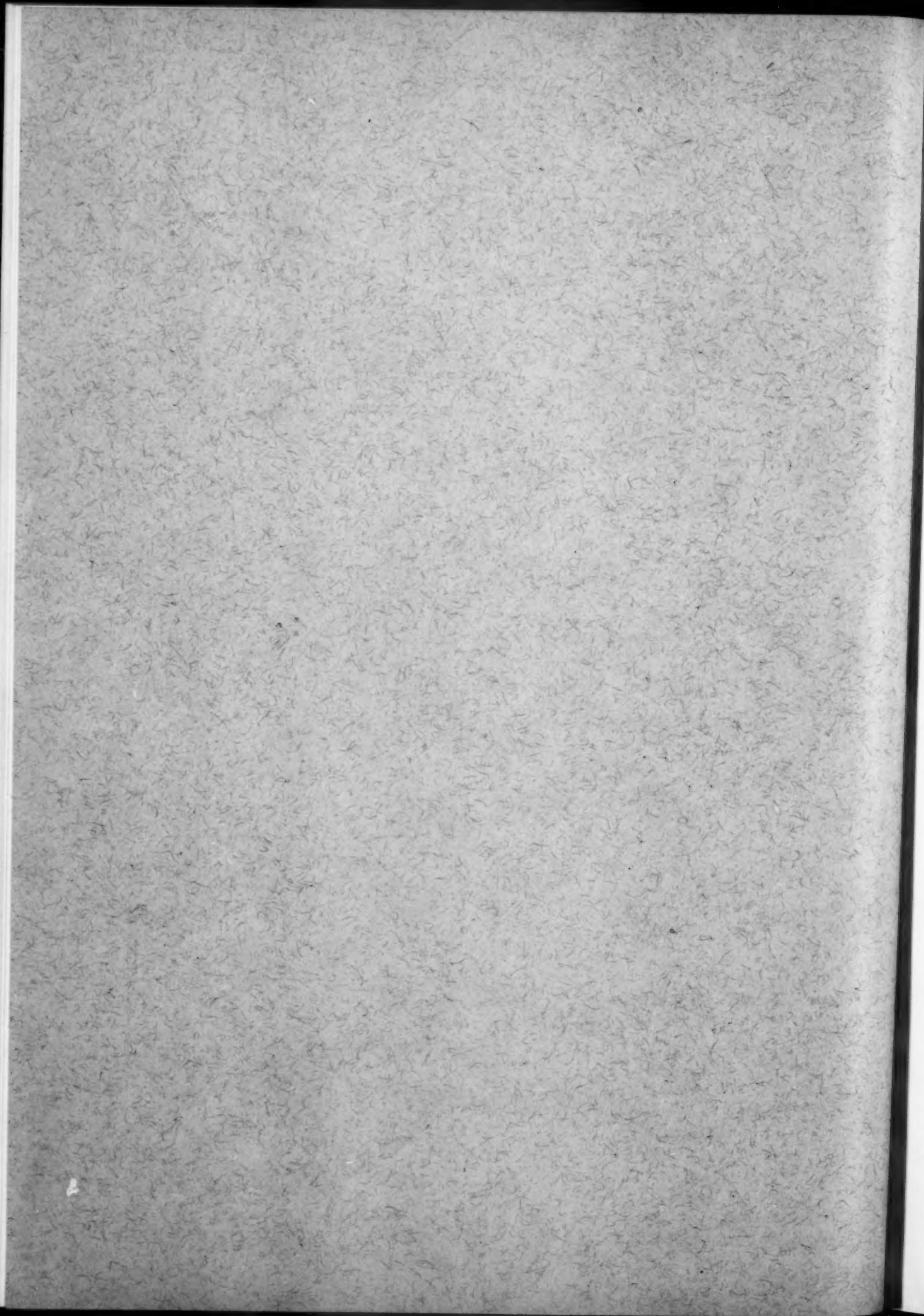
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Gout: Laboratory Considerations With Particular Reference to the Clinical Value of Roentgenological and Haematological Examinations*

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THE object of this communication is to report a correlated analysis of 100 cases of gout studied by laboratory methods and to establish the relative and absolute value of roentgenological and haematological methods of diagnosis. One hundred patients with roentgenological evidences of gout provided the source of material for this study. These were all referred to the pathological laboratory for blood determinations, but we were successful in only securing blood studies on approximately 50 cases. It is proper at this time to call attention to and emphasize the unusual source of the material, inasmuch as so little has been written on a correlated laboratory study of this condition. Practically the only contributions in English on the subject from this viewpoint were those of McClure and McCarthy and their studies were based on active clinical gout, in contrast to our material—mostly inactive and symptomless, accidentally discovered in routine x ray examinations. A comparatively small percentage of cases presented symptoms of clinical gout, actually less than 5 per cent, and a great many of them, 30 per cent, were discovered in the course of roentgenological examinations for injuries or other conditions foreign to gout. In more than 75 per cent, the presence of gout was not even suspected clinically and the same proportion obtains for those cases with never an attack of gout, but with positive roentgenological findings. These figures confirm most emphatically the statement in Osler's system of Medicine* to the effect that "gout is more prevalent

than generally supposed." This view is shared by Fletcher, who states that "notwithstanding the general views as to the comparative infrequency of gout in the United States, there is no question but that the disease is much more prevalent than physicians suppose. In considering the comparative infrequency of gout in this country, the failure to recognize the affection must be taken into consideration".

Gout is a metabolic disease, the intrinsic element of which is an inborn instability of nuclear metabolism which may remain latent, but under the influence of extrinsic factors, such as infection, becomes manifest by local inflammatory tissue reactions in joints or elsewhere, the specific character of which is attested by the associated uratic deposition. With the discovery of uric acid by Scheele in 1776, its demonstration in tophi by Wallaston, and in the blood by Garrod in 1848, the metabolic origin of gout was established. Pursuing these studies further, Folin and Dennis found the normal uric acid content in the blood in individuals to vary from 0.7 to 3.7 mgs. per 100 c. c. of blood², and Pratt, who examined the blood of patients between and during the attacks of gout in mixed and purin-free diets, showed an average of 4.3 mgs.³, thus establishing the presence of a constant hyperuricemia in this condition. Fine stated that he had never seen a normal uric acid in gout⁴. Further investigations on the subject by McClure and Pratt in comparative studies of the blood of gouty, and nongouty individuals, as well as by experiments with purin-free diets, led them to believe that on a purin-free diet the presence of more than 3 mgms. of uric acid per 100 c. c. of blood was

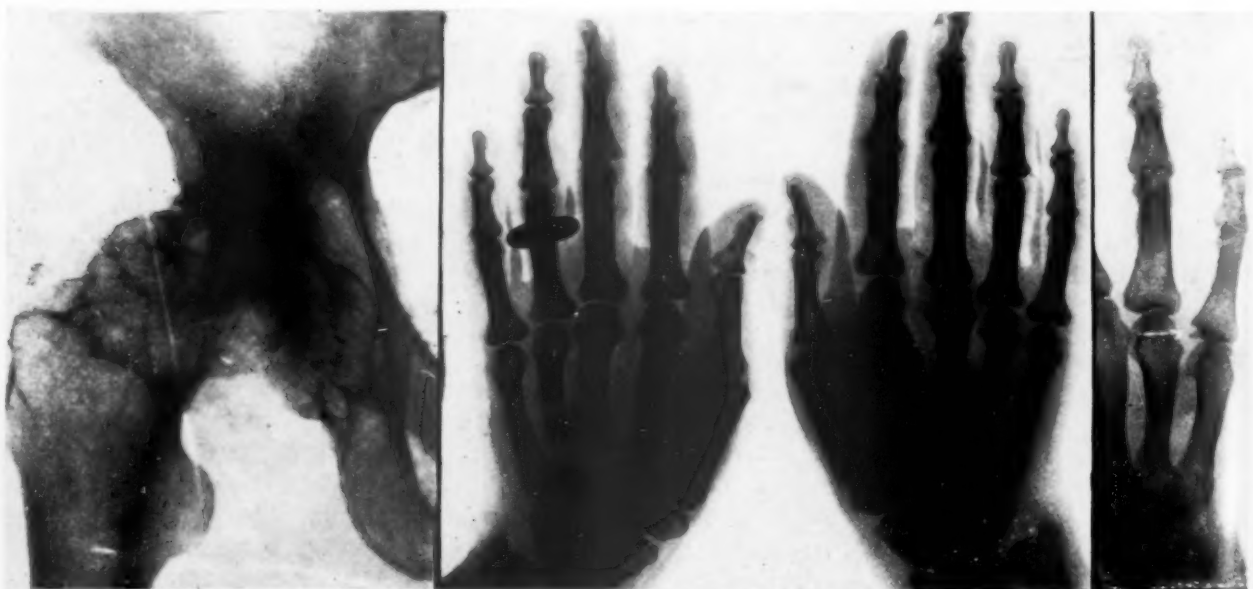
*Read at the Third Annual Meeting of American College of Radiology and Physiotherapy, Chicago, Nov. 12-14, 1924.

suspicious but not pathognomonic of this condition⁶. Our average uric acid in 52 non-gouty cases was 2.6 mgs. per 100 c. c. of blood; in 70 gouty cases our average was 4.86 mgs. per 100 cc. of blood and in 50 cases of gout examined radiographically and haematologically averaged 4.5 mgs. in 100 c. c. of blood. Black in a recent communication in the *Journal of American Medical Association* makes a positive diagnosis of gout even in the absence of proved sodium urate crystals, in a patient who has had attacks of acute arthritis and whose blood uric acid is above 5 mgs. per 100 c. c. of blood examined⁷. Our conclusion is that a hyperuricemia, in the absence of clinical symptoms, but with positive radiological findings indicates the presence of active gout. H. W. Frauenthal suggested that uric acid was a byproduct of metabolism, since by the addition of oxygen, urea could be obtained⁸. Fine, Meyers and Lough showed that in interstitial nephritis there was first an accumulation of uric acid, then of urea and finally of creatinine⁹. The following were suggested by their investigations:

1. Is gout merely a stage in the development of interstitial nephritis whose further progress may be indefinitely delayed?
2. Is interstitial nephritis merely potential gout, in which the clinical symptoms may or may not be eventually in evidence?
3. Is uric acid retention of gout due to the

specific condition, gout, or to a complicating, early, interstitial nephritis?

Roentgenologically, gout manifests itself in most instances in definite characteristic ways which are reproductions of gross pathological changes. By making use of roentgenograms taken at different angles, exact records of minute pathological changes are possible. It is generally conceded that gouty arthropathies have constant definite roentgenological characteristics when soda biurate crystals are present. With Roentgen's epochal discovery, medical pioneers the world over were enabled to open up virgin scientific territory. Various investigators took up the century-old question of gout and one of the earliest publications on the subject in the "light" of the x ray appeared in 1896 from the pen of Huber¹⁰. He reported the presence of multiple circular areas of destruction in the small bones of the hands and feet—sodium biurate, which in his opinion had replaced the normal calcium phosphate of the bone. Franz Grodel¹¹, in commenting on this, says this, "denn kann heute nicht wieder sprechen werden." During the ensuing year a number of contributions appeared on the subject, chief among which were those of Spitzer¹², Potain and Serbenesco¹³, Oudin and Bathelemy¹⁴. The latter writers agreed that the areas described and the appearances presented were not due to bone atrophy, but to the substitution of urates for phosphates of the part. The ear-

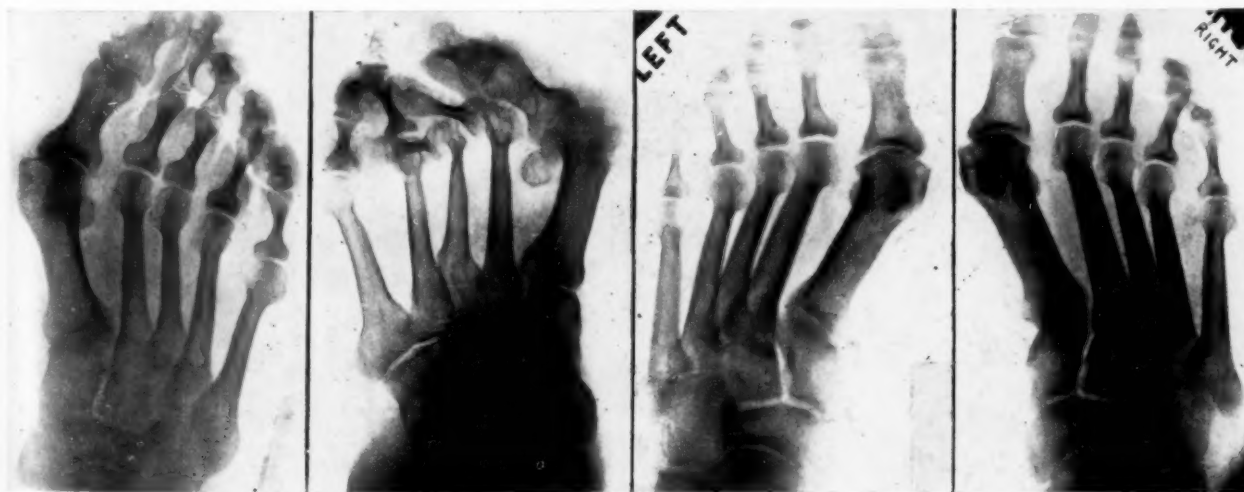


1. Chronic gouty arthritis of the hip with multiple large punched out foci in and adjoining the articular surfaces. Patient had typical blood picture of gout and, in addition, clinical gout in both feet.
2. Kalkgicht—Multiple opaque deposits in tufts of finger tips. On analysis, show sulphur and calcium carbonate. No joint changes.
3. Isolated punched out focus in proximal end of 1st phalanx little finger.

liest American publication on the subject appeared in 1897. The writer thereof voiced his opinion that the "skiagraph demonstrated the fact most perfectly that the deposit of salts has occurred entirely in the tissues surrounding the bones and not in them. This furnishes a means of differential diagnosis between gout and arthritis deformans¹⁵." This erroneous statement proves the enormous strides radiographic interpretation has taken since this was written. The reports of Strange-ways¹⁶, Vorman¹⁷, Dringberg, Jacobson¹⁸, and Koehler next appeared. The masterful dissertation by Dringberg contains an excellent review of the subject up to 1911, but the reader cannot determine absolutely the writer's opinion as to the specificity of the lesions. Jacobsohn¹⁸ classified the lesions in the chronic arthritides of destructive origin. With the exceptions of Huber and Strange-ways, all the authors agree that the radiographic appearance is pathognomonic of gout. Koehler stated that "roentgenological findings were typical and diagnostic of gout," whereas McClure¹⁹ and McCarthy²⁰ believe that "there are no radiographic findings that are specific for gout only."

With the development of more accurate radiography and improvement of laboratory technique, particularly blood and urine analysis, the older concept of this condition has undergone some modification, so that today the varied character of the gouty changes are recognized and their intricate similarity is such as to be diagnosed accurately.

A statistical review of the 100 cases which were observed in the course of about three years shows an incidence of approximately 0.5 per cent of all orthopedic conditions examined in the x ray department. This compares favorably with the incidence at Johns Hopkins Hospital, where the percentage of total admissions were 2.9 per cent. There were no instances of heredity nor familial tendencies towards gout in our series. Only one case showed a general distribution, with involvement of most of the joints of his body, including multiple large joints. The sex incidence in our series is at variance with other reports, indicating definite majorities in the males. Our cases are evenly divided between the two sexes. At least 6 per cent presented combinations of large and small joint involvement and interphalangeal joints of the feet were found to be involved most frequently, 30 per cent, and those of the hands a close second, 28 per cent. The shoulders were involved in 10 per cent, the wrist in 8 per cent, and knees 1 per cent. The acromioclavicular joint had a 3 per cent incidence and the sternoclavicular joint a 2 per cent incidence. Included in our series are three classes of chronic hypertrophic arthritis of the hips, one of the cases with bilateral involvement, presenting large gouged out areas beneath the heads of the femurs. None of these cases presented any roentgenological evidences of any other condition recognizable at this time, but of gout, and because of previous reports emphasizing the absence of involvement of hip joints in this affection, we



4. Arrested gout, with dense sclerotic changes in walls of punched out foci. Conditions usually symptomless over long periods.
5. Chronic gout with multiple lesions. Extensive coalesced punched out areas producing subluxations and marked atrophy of disuse.
6. (a) Left foot, showing two stages of gouty osteo-arthritis. Right first metatarso-phalangeal joint presents multiple discrete punched out foci, with moderate sclerotic changes. The sclerotic bone changes in the absence of synovitis and bone atrophy indicate an arrested symptomless process.
 (b) Right foot of same patient as in 6a, showing synovitis with bone atrophy and marked periarticular soft tissue swelling and thickening, indicating activity of the process.

are calling special attention to these cases. One of them presented dense sclerotic walls in the punched out areas, which we felt indicated **arrested gout**. This case had a normal uricemia. The other cases had high uricemias, and one of them clinical gout in the tarsal joints. We see no reason for disregarding typical roentgenological appearances, wherever present, especially since sodium urate has been found in individuals not suspected of gout.

We regard as highly significant the discovery of sodium urate deposits in the lung and pleura, of a supposedly tuberculous individual, by Weiss and Vogelsang²¹, also Nichols and Richardson's report²², of sodium urate deposits in a knee joint, clinically arthritis deformans. Incidentally, one of our cases with marked bilateral hallux valgus and with discrete punched out foci not involving the articular surfaces, was operated upon to correct the hallux valgus deformity. This patient presented no history of clinical evidences of gout, but the punched out foci removed *in situ* with the heads of the first metatarsal bones, were found to contain sodium biurate crystals.

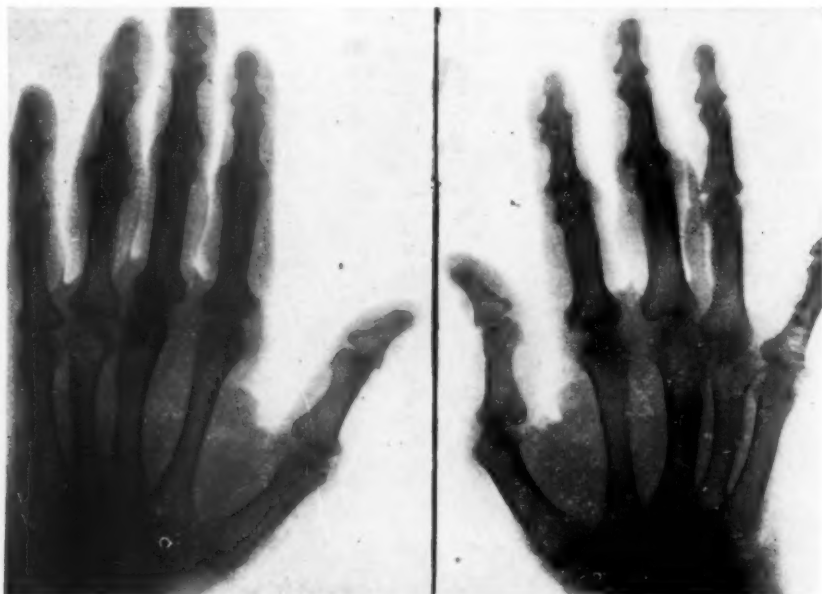
In considering gouty diathesis, one is impressed by its predilection for the small joints, particularly those of the hands and feet. These parts are most frequently affected, although the articular ends of the long bones may be the site of the involvement. These findings are varied and surprising, combining a series of changes unique in the arthritides.

The small bones of the hands and feet, particularly those of the thumb and great toe, are most frequently involved. The metacarpal and the metatarsal, the tarsal and carpal bones and often the contiguous ends of the long bones present evidence of concomitant involvement. The changes in the long bones are of the hypertrophic type, as a rule, although we have seen typical areas of what appears to be gout in the long bones of the shoulder and hips. Changes in the ends of the long bones, however, in the absence of other suggestive pathology, make radiographic interpretation hazardous. The lesions are often symmetrical, but may skip joints in the same part. The pathology is not limited to the joints only. Soft tissue changes are as a rule present, fortunately so, since they call attention to intrinsic bone pathology. The pathognomonic gouged out lesions of gout occur at first in the articular ends of the bones adjoining the chondro-periosteal junction. We offer the following progressive changes as our conclusions, after correlating the different types of gout on a basis of sequence of roentgenological changes. If the condition progresses unfavorably these gouged out foci of bone destruction (or replacement), coalesce, and extend to and involve the articular surfaces, where the crystals are discharged into the joint, and become a source of irritation. As a result of the extension of crystal deposits and bone destruction in the articular surfaces, spur formations occur which also add to irritation within the joint, producing first a synovitis,



7. Gouty osteo-arthritis, acromio-clavicular joint with punched out foci undermining both articular surfaces.

8. Gouty arthritis, tarsal joints.



9. (a) Left hand, showing multiple gouty arthritis with marked destructive bone changes and dense periarticular thickenings. (b) Right hand of same patient, similar condition exists.

then an actual arthritis with permanent bone changes *per se*. Inasmuch as gout occurs in middle age or later, it is usually superimposed upon a pre-existing arthritis of varying type and intensity. Consequently, this pre-existing arthropathy explains why some of these gouty joints present characteristics diametrically opposed to others, i. e., some are distinctly hypertrophic, whereas others are predominately atrophic. The latter type naturally is in excess in the chronic gouty arthritides. During the acute stages indications of synovitis are present, with clouding of the joint space and articular surfaces. Periarticular thickening and swelling are also usually present. As the condition progresses, slight local bone atrophy from disuse supervenes. This gradually becomes more pronounced. Finally the destructive (replacement) process may result in marked joint deformities and subluxations, with mechanical ankylosis and with very pronounced bone and soft tissue atrophy of disuse. On the other hand, should the condition retrogress before destruction of the articular surfaces has taken place, the isolated gouged out foci become quiescent and the crystal deposits are walled off by dense sclerotic changes in the walls of the little bone cavities. They no longer remain a source of irritation to the joint, the soft tissues of which return to normal, leaving a roentgenological picture quite characteristic of arrested gouty osteoarthritis.

CLASSIFICATION

An attempt to classify gout in accordance to a time factor, or depending on a pathological basis according to type, is somewhat unreliable and subject to diversified exceptions. It is as difficult in this as in any other type of medical pathology, to classify this disease radiographically, without other considerations. At best, but a working formula may be employed, and if the classification as given serves in the majority of cases examined, it has served its purpose.

The presence of the gouged out foci *per se*, are indicative of gouty diathesis and the supplementary radiographic findings, with the blood picture, determine the type of condition. We would, therefore, classify the different types of bone and joint involvement as follows:

1. Simple Tophaceous Gout.
2. Acute Initial Gout.
3. Chronic Gout.
4. Chronic Gout with Acute Exacerbations.
5. Arrested Gout.

6. Atypical Gout. Kalkgicht.

1. Simple Tophaceous Gout: Simple tophaceous gout forms the great majority of our cases, more than 75 per cent. They present the pathognomonic roentgen appearances of gout but negative roentgen evidences of acute involvement. Their histories are entirely negative for attacks of gout. The bone changes occur insidiously without symptoms. This type is usually accompanied by a hyperuricemia, but not by local symptoms of any character.

2. Acute Initial Gout: This painful condition forms a small portion of our cases, actually less than 5 per cent. It presents the clinical picture of an acute arthritis. Roentgenological examination of these cases shows a synovitis of the joint, marked periarticular swelling and in early cases no gouged out areas. A high uricemia is characteristically present.

3. Chronic Gout: The destructive changes are seen as multiple confluent gouged out or punched out areas, usually involving the articular surfaces and producing secondary chronic inflammatory changes. The focal areas occur as bubbles of radiolucency, varying in size and shape. As a rule circular, they are often seen as elliptical and sometimes crescentic foci. When seen early they are found under the chondro-periosteal margin at the articular end of the involved bone, beginning in the cancellous structure and then extending through the cartilagenous surface and periosteal sheath. Before the destructive changes involve the joint surfaces and soft tissues structures, the joint may appear predominately hypertrophic. This is because of the pre-existing hypertrophic condition which usually antedates the onset of intrinsic gouty changes. The small gouged out foci gradually increase in size and extent, eroding and destroying the bone, becoming progressively more atrophic, until in the advanced stage complete destruction of the joint surface results.

4. Chronic with Acute Exacerbations: Radiographically, the changes noted are those of synovitis and periarticular swelling and thickening, superimposed upon the picture of the underlying pathology of chronic gouty osteoarthritis described above. Hyperuricemia is present in this type as well as during the periods of intermission.

5. Arrested Gout: This is seen where the condition has not involved the joint surfaces. The gouged out foci present dense sclerotic

walls, showing complete isolation of the biurate deposits. This might be included in the simple tophaceous type, but the roentgen picture is so characteristic as to warrant separate classification.

6. **Atypical Gout:** Reference to American roentgenological literature shows no mention of this particular type of gout. However, Assman's book on "Roentgenological Diagnosis" describes the condition and furnishes an illustration very similar to our own case²³. They term the condition *Kalkgicht*. Inquiries elicited the information that this type of gout used to be quite common a few decades ago, but of late is scarcely ever seen. This can be attributed to general improvement in education on subjects of personal hygiene and diet. The absence of roentgenological records of these cases is readily understood, inasmuch as the period of incidence of this type antedates the advent of roentgen ray. At the present time this type is extremely rare in this country, so much so as to be considered an "actual find." The radiograms show numerous irregular clumps of opaque shaped shadows in the soft tissues under the skin, in the neighborhood of the small joints of the hands or at the tips of the terminal phalanges. These shadows are cast by collections of crystals of sulphur and calcium phosphate. There is no destruction of the articular margins, no gouged out areas, no bone atrophy, nor positive blood findings. The soft tissues are moderately swollen and tender. The disease is probably a disorder of the calcium metabolism and evidently not true gout.

ASSOCIATED CHANGES

The associated changes are sufficiently important to warrant additional comment. These are:

1. Joint Changes.
2. Soft Tissue Alterations.
3. Bone Atrophy.
4. Subluxations.

1. **Joint Changes:** The pathological changes enumerated, occurring in and about the joint, produce changes within the articular surfaces which are more or less obvious. The inflammatory reaction results in chronic synovitis and thickening of capsules. Destruction of the cartilage alters the continuity of the joint surface. The result is deformity at the joint and some degree of ankylosis.

2. **Soft Tissue Alterations:** There are marked periarticular swellings due to active

inflammation. Hard, rather irregular, nodular thickenings are often present. The limitation of motion is due to the presence of both intra- and extra-articular pathologic changes.

3. **Bone Atrophy:** Atrophic changes have been noted as characteristic features in this condition. It is secondary to, and not part of, the disease. The limitation of mobility resulting from an inflamed joint, extending over a prolonged period, is in itself sufficient to produce bone atrophy. This change is true of all the arthritides, luetic, and Charcot joints excepted. The term atrophy as here employed is not of the type seen in tuberculosis where calcium absorption is part of the disease process. Earlier writers believed that the gouged out areas were in themselves a form of atrophy, and this conception is accepted by some writers today. In short, we are dealing here with an atrophy not of disease but of disuse. The changes may be localized or diffuse, irregular or symmetrical. In early cases a slight atrophy is present, but in the long standing cases marked osteoporosis is the rule.

4. **Subluxations:** This is a rather frequent finding, is multiple subluxations. We have seen cases where extensive joint destruction, together with marginal bone proliferation, have produced subluxations, chiefly in the bones of the feet and hands.

DIFFERENTIAL DIAGNOSIS

The most common conditions that may simulate gout are the following:

1. Hypertrophic Arthritis, simple and infectious.
2. Atrophic Arthritis, primary or secondary.
3. Charcot Joint.
4. Tuberculosis.

1. **Hypertrophic Arthritis:** Early gout cannot be differentiated from this condition, roentgenologically, particularly before the stage of bone destruction, because of the high incidence of gout in hypertrophic joints. However, in hypertrophic arthritis the changes at first are usually confined to the joint surface and then, depending on the severity of the infection, the joint surface becomes eroded and by direct extension involves the articular end of the bone. Focal areas of destruction apart from the joint do not appear in hypertrophic arthritis. In short, the pathology is in the joint and only by direct extension does it extend beyond. However, in cases of this type, the blood study for gout is of unquestionable aid.

It must be remembered that gout initially occurs in an hypertrophic joint. Dense periarticular soft tissue thickenings are absent in hypertrophic arthritis, *per se*.

2. Atrophic Arthritis: This is usually characterized by extreme atrophy and extensive erosions of articular surfaces. The osteophytes and the punched out areas of gout are absent. The characteristic, dense, soft tissues are lacking. The atrophy is generalized and not confined to scattered areas. Blood uric acid determinations are invaluable in the differentiation.

3. Charcot Joint, and Luetic Joints: There is little or no bone atrophy in lues. The luetic process in the nature of a periostitis or gumma begins at the surface of the bone at the chondro-periosteal junction, whereas in gout, discrete punched out areas form the initial lesion. There is never in gout the disintegration of the bones which occurs in Charcot joints. History, physical examination and blood examinations are of differential diagnostic value here.

4. Tuberculosis: In this condition there is simultaneous destruction and atrophy. With the exception of the spine, tuberculosis generally involves one joint and is not polyarticular like gout. There are no hypertrophic changes in tuberculosis if mixed infection is absent. Furthermore, this condition early involves the joint surface or immediately adjacent bone and not the cancellous structure as in gout. Soft tissue atrophy is pronounced in tuberculosis. The main differential characteristic of tuberculosis is the characteristic intense clouding of the joint, which is due to dense synovial thickening, bone destruction and atrophy, causing loss in detail of bone structure. This is never present in gout. The soft tissue changes are diametrically apposed. Pronounced atrophy in tuberculosis and local hypertrophic changes in gout. Blood studies are, of course, of value in differentiation.

CONCLUSION

1. Bone and joint changes of gout occur insidiously similar to tophi. They may occur without severe symptoms in any or all stages of development, notwithstanding destructive bone and joint changes.

2. Roentgenological manifestations of gout must be regarded as indications of gouty diathesis. They are frequently symptomless, but subject to acute exacerbations and complications.

3. Gout not infrequently affects the large joints, notwithstanding reports to the contrary. In our series, 3 per cent were of the hips and 10 per cent of the shoulders.

4. The activity of gouty osteoarthritis is determined roentgenologically by a thickening of the synovial membrane and of the capsular and periarticular structures, with a relative degree of osteoporosis of the adjoining bones.

5. The activity of gouty osteoarthritis is determined by blood examination. Positive roentgen findings with hyperuricemia in the absence of increased nonprotein nitrogen and urea nitrogen indicates active gout.

6. Clinical gouty osteoarthritis in an initial attack may be present with a typical blood picture, without characteristic roentgenological appearances. The roentgenograms in these cases only show the presence of synovial and periarticular thickening, inasmuch as no destructive changes have taken place from deposits from sodium biurate crystals.

7. Definite roentgenological diagnosis of chronic gout can be made and substantiated in most cases, with a corresponding high uricemia. When the blood examination shows a low uric acid content, the gouty condition must be regarded as inactive and quiescent, or more simply as indicators of gouty diathesis.

8. Kalkgicht, rare and atypical gout, is really the result of a disturbed calcium metabolism and not true gout, *per se*.

DISCUSSION

Q. I would like to ask the question as to how much of this trouble is supposed to be due to infected tonsils and so forth; we have been taking out tonsils wholesale for the last few years to cure those conditions.

A. Of course I speak from a limited group and I don't voice the sentiment of the practice in New York. I am speaking as an individual, and not for our institution. I do think that this question of tonsils has been exaggerated. There is no connection whatever of tonsils or teeth with this particular type. I believe a more careful consideration of other areas may demonstrate as a focus of infection. Gout has no relation whatever to infected tonsils. Some of these cases might be called infectious arthritis, particularly those of the hips. I have never seen them, they don't come under any other classification of arthritis; certainly we have seen a lot of bone and joint conditions,

but we can't classify them as any other condition but gout.

Tonsils will cause an infectious arthritis, we grant, but not as often as is supposed.

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The Limitations of Physiotherapy in the Treatment of Pulmonary Tuberculosis*

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TUBERCULOSIS has been recognized as a disease entity since the time of Hippocrates, twenty-seven hundred odd years ago. Since that time the brightest minds of humanity have been searching for methods that are efficacious in the treatment and care of tuberculosis. This inquiry has been unceasing; year by year, century after century, the tireless search has gone on. Many things have been hailed as the saviour of the tuberculosis sufferer, only to be discarded after the accumulation of sufficient data as to the ultimate results. Iron, arsenic, strychnine, tuberculin, exercise, massage, high altitude—all these have run the gamut of experience and have been found wanting. Turtle emulsion and green-bone emulsion lag side by side in the race for health; they are making room at their side for tuberculin.

So far there has been found no method or therapeutic agent which will cure tuberculosis—there are but a very few which exert any effect at all, and no therapeutic agent, tuberculin or physiotherapy included, acts directly upon the tubercle bacillus or upon the resulting inflammatory tissue. From the vast mass of therapeutic agents, only a very few can be gleaned which may be considered of any lasting service whatever in the treatment of this disease. And practically all of these, with the exception of one or two, can be replaced by some other method, or left out entirely with but a retarding effect upon the course of convalescence.

The newest of these methods is physiotherapy, especially diathermy and quartz light therapy. These modalities are but in their infancy; their effects upon the course of tuberculosis are little understood. At present they are being applied almost empirically. A vastly greater number of treatments must be given and their results recorded; research pertaining to the effect of these agents upon the body physiology must be more widespread before we can give the final word as to their efficacy

and ultimate place in the role of tuberculosis. It is not the purpose of this dissertation to belittle these modalities, or to discourage their use—far from it. The writer is but attempting to place the few facts we know of them in their proper place in the routine of the treatment of tuberculosis. He has seen the growing tendency to accept them as a cure for tuberculosis; his aim is to stress the fact that they are but therapeutic agents—that they have their contra-indications as well as their indications, and that they but *help* in the treatment.

Before one can prescribe logically a therapeutic agent for any condition, he must ask himself the following questions, and have their answers firmly fixed in his mind: (1), what is the effect which one desires to produce? and (2), what is the action of the therapeutic agent to be prescribed? Failure to realize fully either one of the above factors will result in haphazard treatment which may be, and very often is, more harmful than beneficial. It is a blessing that so many conditions improve in spite of the treatment instituted. There are a few empirical variations to this mode of therapy, but they have no bearing upon the present theme, and, with continued advancement in pathology and physiology, the empirical mode is rapidly diminishing.

Before going into the question of treatment more deeply, it is well to inquire into the newer aspects of the pathology of pulmonary tuberculosis. The disease is caused by the tubercle bacillus, which lodges in the peribronchial and mediastinal lymph glands. A very important factor is the fatty capsule of the bacillus. This complicates the treatment very materially in that it serves as a protection for the organism. Another consideration cannot be too strongly stressed at this time. The infection of tuberculosis *practically always* (with few, rare instances which have no bearing upon our discussion) takes place in *early childhood*, almost always before the fifth year of life, and more often during the first or second years. The infection generally comes from a parent, and in the vast majority of cases from the mother. And, *when one parent has the disease, diagnosed or undiag-*

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nosed, none of the children escape the infection. They may not develop the disease entity, which is rare, or they may not break down until after the eighteenth year, which is common, but they cannot escape the infection nor the scarring in the chest. Practically every case which comes to the physician for diagnosis or treatment will give symptoms dating back to, or before, the fifth year of life. It is but a matter of knowing the early symptoms and of patience in eliciting history.

The Koch bacillus lodges in the mediastinal lymph glands, where it multiplies and causes irritation, tissue destruction, and liberates, as a result of its metabolic activities, a toxin. The body defenses set about counteracting the activities of the bacillus by the production of fever and deposition of scar tissue. In those instances where these defenses are adequate, the invading germ is surrounded, walled off, and buried in a marble sarcophagus. The process of ridding the body of the infection, however, is not rapid—in every case *it is a matter of years*. No matter if physiotherapy be used or not, *time* is the greatest element in the treatment of tuberculosis, and it must never be lost sight of as the most important factor of all.

The tubercle bacillus is one of low virulence—it insinuates itself into the tissues very quietly, and good naturedly goes about its activities. It likes its host and is willing to be content with little. Thus, because of its low virulence, the body defenses are marshalled quite slowly; the process of scar deposit in an ordinary case of pulmonary tuberculosis is a matter of years. The fever in most early cases is quite low; very often it is absent and sometimes elicited only after undue exertion. Toxemia is slight, the cough light and generally unnoticed for years. The pain (unless the pleura be encroached upon) is negligible. Antibody formation proceeds slowly, and immunity it built up gradually. The tubercle bacillus is enclosed in a fatty capsule. While this capsule prevents a rapid diffusion of toxin into the tissues and blood, it also has the adverse action of preventing easy destruction of the organism by the body defenses, drugs, etc. Were it not for this fatty capsule, the problem of tuberculosis would be much more easy of solution—it would either cause such a violent toxemia and reaction that death would soon ensue—as in bubonic plague—or, the body would marshal its defenses rapidly and adequately enough, and in great enough volume to annihilate the invaders in a violent cataclysm, such as occurs in typhoid fever. A

vaccine would then be undoubtedly potent. Under present conditions, however, the course of the disease consists of a zig-zag race between tissue destruction and scar formation, with a predominance of first one and then the other. To our present knowledge—and newer researches enhance this view—this see-saw race persists throughout life in any case of tuberculosis, even in the so-called “healed” ones.

The toxin of the tubercle bacillus, although liberated in small quantities, is a very powerful one and very destructive, as the action of tuberculin demonstrates. Its actions are several; these, acting mildly but continually through the years, may and do cause very definite results. The toxin attacks the nervous system first, upon which its action is very similar to that of alcohol. In the earliest inception of the disease, when the toxin is liberated in very small amounts, there is simply a stimulation of the cerebrum and a quicker reaction time to all external stimuli. Witness the small child born of a tuberculous parent. Two years ahead mentally and two years behind physically—a good student, keen intellectually, very nervous, and high tempered. It is impossible for it to remain quiet for the shortest time without squirming in its chair, twiddling its fingers, tapping its feet, or getting up and walking around. This is noticed as early as the fourth year. Nothing may be found in the chest on physical examination, for the tissue changes have not become massive enough to be heard through the chest wall. But they are there, nevertheless. There is a peculiar mother-of-pearl lustre to the sclera. Later, as the organisms multiply and the amount of toxin becomes greater, we find the irritation extending to the autonomic nervous system, giving us as signs a reflex tension of the various muscles of the shoulder girdle, the wing scapula, the rapid pulse, the “nervous indigestion”—which is a reflex from the mediastinum along the vagus nerve. Afternoon malaise becomes evident, and evening stimulation—the patient is never so awake as when bedtime comes. Slight hoarseness is frequent; often croupous or “asthmatic” attacks torture the parent and bewilder the physician.

These symptoms may persist for years before the pulmonary changes become massive enough to be heard through the chest wall as “physical findings.” Persistent, patient questioning will elicit from practically every case of tuberculosis that the foregoing symp-

toms were present in early childhood. As the years go on, and the bacillus slowly gains ascendancy, the foregoing symptoms become more marked. In addition, the mental processes become affected. The patient becomes moody, irritable, suspicious, and the classical attitude of "hopefulness" becomes very strongly marked. The better judgment becomes clouded, psychotic acts, thoughts and actions occur. Finally in the terminal stages, when the system is flooded with toxin, apathy and eventually coma supervene. This action of the toxin in tuberculosis is by far the most widespread and the most difficult phase of the disease to combat.

Although repair and healing are one continuous process, this process may be divided into two distinct phases; (1), the deposit of scar tissue, and (2), calcification. The habitat of the tubercle bacillus becomes a point of irritation in the lung. As a result of this irritation, connective tissue proliferation ensues. If the proliferative tendency predominates, a firm, small scar is built up; if, on the other hand, the destructive process attains the ascendancy, caseation follows, and the healing becomes more difficult after proper treatment is instituted. In the former instance, the scar contracts and gradually becomes firm and hard. Finally calcium is deposited in it to such an extent that the area literally becomes petrified. These calcified areas are hard and gritty, cutting like soft stone. "Healing" may then be said to have occurred. But, *even a firmly calcified scar may contain virulent bacilli for years.*

When caseation progresses, the softened area finally reaches a stage where the tissue support gives away and the pathological tissue sloughs out. Thus a cavity is formed. If the cavity is small it may heal and scar over. If over one inch in diameter, the usual rule is that it keeps enlarging and fills with pus and secondary infection occurs. Drainage is poor and the cavity becomes a focus of infection. The natural elasticity of the lung tissue is overcome around the borders of the cavity; the cells are pulled apart further and further—their resistance is lessened more and more and the cavitation spreads. The body then begins to throw a heavy fibrous wall around the cavity. If successful, this delays the spread; this wall may become very thick and hard—like an eggshell. Another obstacle is then in our road—the wall holds the cavity open; its edges cannot approximate, and the healing process is defeated.

If a blood vessel lies in the path of the advancing area of destruction it is but a matter of time until its wall is attacked, severed and hemorrhage takes place. If small, the lumen is easily occluded by clot, and this clot may advance with the progress of the spread. If the vessel is large, serious hemorrhage results and from time to time is repeated. It is impossible for the clotting to keep pace with the advance of the lesion.

The healing of tuberculous lesions in the lung is influenced profoundly by two factors: (1) respiratory excursions of the lung, and (2) low calcium content of the blood and lymph. When an arm is broken it is placed in a rigid splint and allowed no movement whatever. Where a broken bone cannot be immobilized and play is present, healing is slow; often nonunion persists until the fragments are immobilized. Following severe cuts, lacerations, large incisions, etc., the affected area is put to rest as absolutely as possible. In a healing lung this cannot be done. Pulmonary movement is requisite to respiration and the maintenance of life. At each inspiration the alveoli distend with air; at expiration they shrink from their own resiliency. This alternate distension and collapse takes place from 18 to 24 times a minute, 1,080 to 1,440 times an hour, or 25,960 to 34,560 times during twenty-four hours. If an alveolar wall becomes weakened it easily sloughs through under a slight extra strain such as coughing, shouting, singing, etc. Here, then, is a powerful drawback to healing. As the lung expands and contracts, infection is often "milked" through the tissues.

A factor often lost sight of is the slow calcification of the lesion. This is due to the low concentration of calcium and other salts in the blood and lymph. Brubaker gives the calcium content of the blood as 0.2 per cent and that of the lymph about the same. The total of all the inorganic salts of the blood is but 0.8 per cent and that of the lymph likewise. Calcium metabolism takes place very slowly in the body—only 0.4 gm. is excreted daily from the bones, tendons, etc. The concentration of calcium in the blood cannot rise very much above this level, else death from irritation occurs very quickly. Thus we have the tuberculous lesions crying for calcium, and the blood and lymph reluctant to part with even a little of their meagre store, lest the body suffer seriously. The body will take up only enough calcium to keep this concentration; all other is excreted. It will give up only enough to

reach this concentration, lest serious conditions arise. Because of the small concentration of this salt in the blood, permeation of the lesions is very slow indeed—six months' time shows imperceptible progress. Calcification of a tuberculous area is a matter of *years*; and no lesion is safe from breakdown until it is calcified.

There are, then, three factors concerned in the healing of pulmonary tuberculosis, which are of prime importance:

1. Deposition of scar tissue.
2. Calcification of the scar tissue.
3. Lessening of the respiratory excursion.

The first two represent a continuous process; the third is subject to variation almost every minute of the waking day, and often during the hours of sleep. Walking, talking, singing, excitement, laughing, nervous tension—all these have a definite accelerative or amplifying action on the respiratory rate or the increase in intrapulmonary tension. The progress of typhoid fever, infections and fractures is measured by hours, weeks and days—the *same progress in pulmonary tuberculosis is measured by months, decades and years!* Whereas the duration of typhoid fever is measured by six or eight short weeks, that of pulmonary tuberculosis embraces the entire span of life—from the cradle to the grave. Very few physicians, and fewer patients, have the breadth of outlook, the patience and the tenacity of purpose to follow the long, bleak, unending path of uninterrupted treatment unless driven to it through fear as the result of untoward symptoms, which latter come, almost always, when it is too late in the disease to effect any more than a temporary arrestment. This is the tragedy of tuberculosis—there are no early, tangible symptoms, remissions mislead, slight treatment causes a remission which may blind the physician and lead the patient on with a false hope. Many cases present the same phase—false hope, insufficient advice.

We return, then, to the questions propounded at the beginning of this paper: (1) what effect do we wish to produce to promote healing?, (2) what are the actions of the physiotherapeutic modalities advocated for the treatment of tuberculosis?

In treating tuberculosis, we wish to accomplish the following ends:

1. Destroy the invading organism.
2. End the extension of tissue destruction.

3. Repair with scar tissue the damage done by the disease.
4. Rid the patient of symptoms.
5. Rid the patient of toxemia.
6. Make him as capable as possible of "carrying on" in life.

How many of the foregoing anticipations will physiotherapy accomplish, or aid in accomplishing, and how? In the present stage of our knowledge *it is generally conceded that actinic light, whether quartz or solar, will do the following:*

1. Increase the body metabolism.
2. Increase the hemoglobin content of the blood.
3. Increase the number of red cells in the blood.
4. Improve the appetite.
5. Cause a reflex, local hyperemia.
6. Temporarily stop reflex pain in many cases.
7. Perhaps increase actual calcium content of blood (doubtful).

The actinic light will not.

1. Penetrate the body tissues over a few microns.
2. Affect the tubercle bacilli directly.
3. Affect the lesions directly.
4. Cure the patient in a few treatments.
5. Directly increase the deposition of scar tissue.
6. Change the mental makeup of the patient.
7. Change the circumstances or environment of the patient.

The actinic light may act adversely by

1. Flooding the patient with toxemia (especially blondes).
2. Reopening or increasing hemorrhage.
3. Overstimulating metabolism, thereby defeating the object of rest.
4. Placing the patient in a position of false security by making him think that he is "cured."

Diathermy acts but in one way—through the medium of the heat generated in breaking through the resistance which the body tissues offer to the passage of the electric current through them. *The action of diathermy, according to our present knowledge, is*

1. Increased heat—artificial, local fever.
2. Increased local metabolism.
3. Inhibition of the growth of invading organism.

4. Stimulation of deposition of scar tissue.

Diathermy will not

1. Kill a great number of the organisms.
2. Detract materially from the time element in treatment.
3. Change the mental makeup of the patient.
4. Alter the circumstances or environment of the patient.

Diathermy may act adversely by

1. Increasing the toxemia.
2. Reopening or increasing the chances of hemorrhage.
3. Stimulating the invading organisms.
4. Placing the patient in a position of false security.

It appears to the writer that the only therapeutic action of the actinic light in the treatment of pulmonary tuberculosis is the general systemic effect. If a local, reflex hyperemia be produced by the actinic rays—and to date it has not been positively proved to be produced—it is a question in the writer's mind whether or not its disadvantages outweigh its advantages in many cases. At any rate, the great benefit derived from actinotherapy is the general systemic effect. Through this means the body is aided in its effort to overcome the disease. Likewise with diathermy—it but *aids* the body in its efforts to overcome irritation and stop tissue destruction. The fatty capsule is a powerful defense; it is very resistant to destruction. As a matter of fact, it is very doubtful whether the bacillus can be destroyed *in situ* at all, but must be surrounded and starved out in every case. One thing is certain—a therapeutic agent which would be powerful enough to destroy the bacillus *in situ* would undoubtedly first destroy the less resistant parenchymal cells about it.

Why, then, use the actinic light and diathermy? Are they useless? Can they be replaced by something else? In using them, is the physician taking advantage of his patients?

Not at all. They are not useless; they cannot be replaced by anything as good or better

in their sphere. These modalities have a definite, beneficial action in the treatment of pulmonary tuberculosis and an unsurpassable place in the physician's therapeutic armamentarium. The motive of this dissertation is to attempt to give physiotherapy its rightful place in tuberculosis therapy—also to try and define its limitations and prevent its falling into disfavor through misapplication. For, what can be more destructive to a physician's prestige than to have the hopes he held out to his patients prove false? How futile it is to assure a tuberculous patient that he will be cured and need not worry after a complete course of ten, twenty, or whatnot number of treatments? And then to have him break down with the disease in anywhere from three months to five years!

To repeat—physiotherapy must be considered *merely as a therapeutic agent*—one which, if used correctly, will aid, but will not cure—that other, far more important things must be done along with physiotherapeutic treatment. In closing, therefore, allow the writer to suggest, in their order of importance, the treatment which every tuberculosis patient should receive, and which he or she is entitled to:

1. Early, definite diagnosis of tuberculosis.
2. Education as to the process and the time element.
3. Removal from circumstances which broke him down—and *keeping him away from them for life.*
4. Enough rest physically.
5. Enough rest mentally.
6. Heavy, full protein, carbohydrate and fat diet.
7. Fresh air, sunshine and congenial surroundings.
8. Removal of excess load—focal infection, etc.
9. Physiotherapeutic treatment.
10. Patience on the part of the physician.

Unless these are observed in every case of tuberculosis, success in the treatment will be meagre and spasmodic, and physiotherapy will be unavailing or only temporarily successful.

Diathermy in Middle Ear Pathology—Preliminary Report*

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ANY therapeutic measure that will favorably influence faulty hearing, or tinnitus aurium, offers to a large group of sufferers a blessing for which they will be uniformly grateful. Our most valued special sense is that of hearing. Any considerable impairment of that sense is a serious misfortune; practically total loss is a calamity. Of all distracting ailments which drive patients to us for relief and still, at the same time, permit them to carry on uninterruptedly their daily tasks, nothing aside from acute pain irritates and disconcerts them so much as head noises.

Impaired hearing due to certain definitely recognized pathological conditions classified under Chronic Nonsuppurative Middle Ear Diseases, is very likely to have associated with it some type of head noises, and any therapeutic measure that will relieve the one is prone to favorably influence the other. There are, therefore, two conditions which are immediately thought of when a history of impaired hearing is presented. These conditions are chronic nonsuppurative middle ear catarrh and otosclerosis. This is especially true if the impairment was first observed in middle life, having been noticed only occasionally during the first few years, more particularly when suffering from a cold, and, if after one, three or five years it fixed itself with unyielding tenacity and from year to year was noticeably more disturbing. Along with this impairment of hearing, there will very probably be complaint of head noises in one or more of the many types with which you are all familiar. At first only the faulty hearing may have been observed, followed later by the tinnitus, or head noises may have been observed slightly before the first shading of hearing was noticed.

DIAGNOSIS

Because of the favorable influence exerted upon chronic nonsuppurative middle ear pathology by properly applied diathermy followed by a mild Surging Sinusoidal current, and because of the absolute hopelessness of in any way exerting any observable influence upon a definitely established otosclerosis, which in many instances it closely resembles symptom-

atically, a few points by way of a differential diagnosis may be enumerated. But it must first be realized that in no case of faulty hearing or head noises should treatment be instituted until tuning fork and other tests shall have been carefully made and carefully recorded. Treatment of tympanic deafness is based upon a definite diagnosis that tympanic deafness really exists. We are disregarding in this paper the etiology and the pathology of nonsuppurative middle ear diseases, and of otosclerosis as well. Neither are we to consider in any way deafness due to chlorosis, typhoid, mumps, syphilis, blood toxins, Meniere's disease, paralysis of the auditory nerve, leukemia, tuberculous suppurative labyrinthine or other conditions. We are concerned here only with the differential diagnosis between chronic nonsuppurative middle ear trouble and otosclerosis, and with the use of certain electric modalities. Chronic nonsuppurative middle ear pathology is here used to designate all the varied conditions covered under this head. Let us then recall these points in the differential diagnosis:

1. Colds in any form tend to disturb the hearing in middle ear catarrh. They do not influence the hearing in otosclerosis.

2. Rhinitis, pharyngitis, hypertrophied turbinates, polyps, paranasal sinus involvement, all aggravate middle ear catarrh. They do not modify the hearing in otosclerosis.

3. Tonsillitis and adenoid infections are prone to aggravate catarrhal deafness. They do not effect otosclerosis.

4. Swelling of the lymphoid tissues about the mouth of the tube and tubal edema are disturbing factors in catarrhal deafness. They do not bother in otosclerosis.

5. Recurrent mild myringitis, with arterioles along the insertion of the malleus and with the tympanic congestions, edema and occasionally fluid in the tympanic cavity, point to middle ear deafness and may be the cause of it. They are not a part of, nor do they especially influence otosclerosis.

6. A feeling of fullness in the ear, with retraction of the drum head, points to middle ear catarrh. They are not indicative in any way of otosclerosis.

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7. Heredity plays little part in middle ear deafness. In otosclerosis heredity is a commonly traceable factor.

8. One ear alone is commonly involved in tympanic catarrh. In otosclerosis bilateral involvement occurs in 88 per cent of the cases.

9. Hearing is almost never totally lost in tympanic nonsuppurative trouble. In otosclerosis deafness is frequently total.

10. Although tympanic catarrhal deafness is most frequently encountered in middle life, it is not uncommonly seen in young persons. Otosclerosis is essentially a disease of middle life and beyond.

11. Relapses in tympanic catarrhal deafness may develop suddenly, while otosclerosis is always gradual in its advance.

12. Vertigo is not present in catarrhal deafness, and is present in cases of otoscle-

rosis in a ratio of a little higher than one in five.

13. Sex has no influence in catarrhal deafness, while almost 60 per cent of sufferers from otosclerosis are women.

14. Child birth and anemia bear no relation to catarrhal deafness. They aggravate cases of otosclerosis and may be concerned in its etiology.

15. Fixation of the ossicles, with limited movements of the membrane, may be present in catarrhal deafness. It is almost never absent in true otosclerosis, which is an inner ear disease and has its origin in the bony capsule of the labyrinth.

16. Nasal obstructions in lymphoid tissues about the mouth of the eustachial tubes are responsible factors in middle ear deafness. They bear no relation to otosclerosis.

17. Tubal inflation, the various types of pneumomassage and other treatments favorably influence tympanic catarrhal deafness. They never favorably affect an established otosclerosis. They tend to aggravate the condition.

18. Paracusis is an occasional symptom of hyperplastic middle ear impairment. It is a fairly constant symptom in otosclerosis.

19. If compressing the air in the external canals increases low-tone bone conduction, it points toward catarrhal deafness and away from otosclerosis (Gelle's sign).

20. Catheter inflation frequently displays evidence of a closed or restricted tube, with rales or crackling sounds and muffled tympanic tones evidenced in catarrhal deafness. The tubes are normally open, free and dry in otosclerosis.

21. Where a patient observes a far greater impairment of hearing for conversational tones than is indicated by the tuning fork tests, it points strongly to tympanic catarrhal deafness.



Fig. 1—Method of attaching coils to high frequency machine, enabling us to treat two patients simultaneously.

Fig. 2—Close up photograph showing the head pieces used for applying the current in the auditory canal.

22. Loss of lower tones, with higher tones unimpaired, points strongly to otosclerosis, while shading of the full range of tones from high to low strongly indicates tympanic deafness.

23. Bezolds triad of prolonged bone conduction, loss of lower musical tones, and Rinne minus, always means fixation of the foot plate of the stirrup and means a thoroughly established otosclerosis, or a chronic hyperplastic otitis of advanced degree.

With these evidences of chronic nonsuppurative middle ear pathology clearly in mind, with anything like an established attack of otosclerosis and the above listed diseases ruled out, and with the opportunity to follow up regularly administered treatments for reasonable time, I believe we have, in properly applied diathermy a remedy of very hopeful promise.

It is only possible to deliver to the tympanic, labyrinthine and eustachian structures sufficient amperage to effectively influence them, and still remain within the bounds of tolerance and safety, by including directly between two properly sized, properly shaped, bipolar electrodes, a core of tissues embracing these structures, and by passing directly through this core of tissues from side to side a current of proper voltage and proper amperage to accomplish the result desired.

From no meatal electrode alone, certainly from no unipolar meatal electrode with the indifferent terminal placed distant from a line drawn directly beyond the impaired organs, can current be delivered, sufficiently deep and in amperage sufficient to accomplish any considerable helpful result. The convective leakage into the proximal tissues from so limited a contact surface as the walls of the external meatus alone, renders practically negative any efforts to produce a plus temperature of very helpful degree in the structures impaired.

TREATMENT

With a diagnosis of nonsuppurative middle ear deafness, either with or without tinnitus, thoroughly established, the technique below outlined has proved of decided benefit in many cases and curative in an encouraging percentage of those treated. This technique as worked out and employed by the author in daily private practice, offers a maximum of efficiency. The measured dosage is under *positive control*, it is delivered definitely to the parts involved, and it offers real encouragement to a large

group of sufferers to whom little encouragement has come, up to this time.

Nasal deformities when pronounced and nasal obstructions when present receive attention. Adenoids, if present, and tonsils, when disturbing, are of course to be removed operatively.

Inflation of the eustachian tubes by means of the catheter, practically always precedes application of the current. An auscultation tube attached to a small stethoscope, from which the bell has been removed, will effectively shut out all noises and enable the physician to learn during slow, gradual inflation, by steady pressure, very much of the condition of the tubes, and it will afford some information as to the condition of the tympanum. Inflation by means of the catheter, with auscultation tube and a uniform uninterrupted air pressure of 20 to 30 pounds is essential for satisfactory examination and is always preferable for treatment purposes. Politzerization is never as satisfactory, and tells nothing more than the single fact that air can be forced along the eustachian tube under sudden pressure aided by pharyngeal wall contraction. Inflation by means of the catheter is in every way preferable for diagnostic and treatment purposes.

Where dilation of the tube is tardy or ineffective, or where the tube is found to be closed by strictures, edematous or collapsed, we are obliged to use a massage machine as an aid in producing satisfactory inflation and for its treatment effect.

Where the eustachian tube is found to be extremely patent throughout, and where the dry rushing sound of a rather high pitch gives the impression to the physician of a rapid air current through an open tube together with an indescribable resonance suggestive of tympanic emptiness, a diagnosis is made of a tubal wall atrophy with the same condition involving more or less the tympanum. For such a condition, the author has found satisfaction in the use of the following solution:

Dionin	2 per cent
Benzoic Acid	1 " "
Strychnia	1/10 " "
Sodium Chloride	1/5 " "
Alcohol	20 " "
Water	77 " "

Five drops of the solution are, once, twice or three times a week, blown as a coarse spray through the eustachian catheter, a portion of it reaching the tympanic cavity. There is

usually an exacerbation during the following twenty-four hours in the deafness, but it has not been observed in the tinnitus. Of course, no one would be so unwise as to force a solution into the tympanic cavity in the presence of mucous rales, a rhinitis, a pharyngitis, a tonsillitis, or other infective condition.

A loosely shaped pledget of cotton that will hold ten drops, is dipped into the following solution:

Benzoic Acid	2	per cent
Strychnia	0.33	" "
Sodium Chloride	1	" "
Glycerine	20	" "
Alcohol	17	" "
Water	60	" "

This pledget of cotton thoroughly saturated is then placed lightly but snugly against the drum head by means of forceps.

The Linn Biaural, Bipolar Electrode is used in administering these treatments and enables one to deliver to the pathological structures a measured amperage in the dosage desired. The loosely wound, cotton covered tip of the metal electrode, after being thoroughly saturated with salt solution, is then turned down into the meatus until it comes in contact with the pledget already in position—thus completely filling the meatus with a good conductor and good contact.

The Extra-Aural block tin pads are now placed in good contact against the skin behind, below and in front of the auricle and the connections are then made, with the selector switch on the third button, when treating one patient, and on the fourth button when treating two patients. The amperage is slowly raised, at least two minutes being required, until the 400 mark on the reading is reached—never over 500—and maintained at that point for fifteen or twenty minutes, depending on the chronicity of the case. The amperage is then slowly reduced, the switch thrown open and the block tin pads removed.

With the meatal electrodes still in position, the selector switch is placed on the first button, the current turned on and the amperage raised with great care to the point of comfortable tolerance to the patient and so maintained for five minutes.

The D'Arsonval current is followed by the Surging Sinusoidal at comfortable tolerance for two minutes.

It has been found that to continue the diathermy at 400 beyond twenty minutes practically always produces a mild vertigo of 20 to 30 minutes duration; and this result has been noted equally in patients in vigorous general health and in nervous patients with limited strength. Age does not seem to influence the probability of this vertigo nor its duration which is never prolonged beyond thirty minutes and is thoroughly transient.

This transient vertigo demonstrates clearly that the labyrinthine circulation is influenced by the plus temperature developed within the osseous capsule and leaves no doubt whatever as to reaching, by means of this technique, the various areas in the middle ear, labyrinth and eustachian tube.

Treatments are usually given every day for two or three weeks, then every second day for as long, and finally twice a week for a time although the frequency of treatment must be determined by the case.

With this technique carefully followed, with impossible cases eliminated, and with treatment continued faithfully for a reasonable length of time, favorable results will be obtained in a very satisfactory percentage of the cases and very convincing results will be obtained in many.

RESULTS

A resume of the tuning fork and other tests on which a diagnosis is based and the prognosis is made in individual cases would be quite out of place in this paper, but the results of treatments in a few cases may be cited:

Case 1. 3-10-24. Mr. J. T., age 49. Faulty hearing more marked last three months, some pain for a few days. Tinnitus persistent and annoying. Right ear hears watch 28 inches. Left ear hears watch 3 inches.

4-17-24. Patient above after treatment. Right ear hears watch 30 inches, left ear, 22 inches. Entirely free from tinnitus, and no discomfort in any way. Considers himself well and regards further treatment unnecessary.

Case 2. 7-24-24. Mr. E. J., age 65. Faulty hearing many years with tinnitus very annoying until patient moved to Colorado. Less disturbing now. Cannot hear watch in either ear, even on firm contact.

9-2-24. No tinnitus. Hears conversation much better. Hears watch in right ear at 11½

inches, in left ear, at 1 inch. Can now hear his own watch under his pillow in bed. Returned to his home in Colorado.

Case 3. 5-22-24. Mrs. G. B., age 55. Tinnitus, puffing, purring sounds, which are persistent. Hears watch in right ear at 20 inches, left ear, 6 inches.

10-21-24. Tinnitus entirely lost. Right ear hears watch 28 inches, left ear hears watch 20 inches. Conversational tones much more easily heard.

Case 4. 10-4-24. Miss E. B., age 40. Catches cold easily. Tinnitus mild type, of four years duration. Right ear hears watch 8 inches, left ear hears watch 4 inches.

10-14-24. Right ear hears watch 26 inches, left ear hears watch 16 inches. Tinnitus observed only occasionally.

Case 5. 6-28-24. Mrs. L. H., age 53. Tinnitus of persistent pulsating sound of escaping steam for two and one-half years. Very annoying and worse when lying down. Right ear hears watch 8 inches, left ear hears watch $\frac{1}{2}$ inch.

7-14-24. Throbbing pulsating sound very much less, can turn over in bed without much tinnitus being observed.

7-30-24. Right ear hears watch 44 inches, left ear hears watch 30 inches. No tinnitus whatsoever either when up or when lying down. Case dismissed and instructed to report once a month.

The cases here reported each had treatments every day or every second day for two weeks, then twice or once a week. Each had inflation when indicated. Each had diathermy for either fifteen or twenty minutes and in each case the diathermy was followed by the Surging Sinusoidal current up to the point of comfortable tolerance for two minutes, the surges running sixty to the minute.

The above, very brief case records and this entire paper, which is presented only as a preliminary report, offers encouragement in following out in detail the treatment as outlined.

In all the considerable number of cases that I have treated, following out substantially the treatment as above outlined and in which the diagnosis of chronic tubo, tympanic, or other nonsuppurative middle ear pathology had been established, encouraging results have been attained.

I am hopeful indeed at the end of another year to combine with my own, equally good reports from some other careful men who are employing practically this same technique.

DISCUSSION

Dr. A. R. Hollender (Chicago): I want to go on record as confirming the results which Dr. Linn has so modestly claimed, but I want to suggest an additional point of the technique, and that is this: we have used diathermy and the rhythmic current in the ear for almost a year now in a series of probably 100 cases and recently we have found that our results are very much enhanced by the concomitant use of diathermy in the nose—that is the diathermy in the nose may be used either prior to the ear treatment or subsequent to it.

We have also experimented with a plan of applying diathermy in the nose at the same time as it is applied in one ear, and the technique consists simply of something similar to the way the doctor suggested, taking a piece of cotton and saturating it with normal salt solution and packing it high up into the nasal chambers. The same is done in the ear, that is, packing the ear canal with cotton and introducing an electrode into the cotton. By this means we have greatly shortened the period of time necessary to treatment of these cases. Our results have been very, very good.

Dr. L. M. Otis (Salina, O.): There is one thing that I wish to add to the technique and treatment of some of these ear cases, and that is vibration. If you place your vibratode to the opposite side of the area you are treating and give vibration in a number of these sclerosis cases you will achieve gratifying results.

Dr. B. H. Sherman: I wish to mention that which the author failed to mention, namely a very ingenious radio head piece devised by himself for this administration. We added it to our equipment and it is very nice. It puts the current right through the head. It always stays right in place and it is a very nice thing to use.

Chairman Curran Pope: With your permission the Chair will add a further modality in the management of these cases, and that is the x ray. Once every eight to ten days we give an x ray treatment: spark gap five inches, anode twelve inches, milliamperes meter reading five milliamperes, filter one to two millimeters of aluminum, time, five minutes or twenty-five milliamperes minutes, giving on one day the treatment so that it passes directly

through as the doctor has insisted, and the next treatment on the other side—that is to say, passing it through the right side today and in a week or eight days through the left side.

We also found that it was exceedingly beneficial to use a three inch metal cone and the rays would pass directly through the skull.

I would like to ask Dr. Linn what shaped electrode he uses or what shaped piece of block tin he uses attached to the double head piece.

Dr. Ellis G. Linn: The illustration shows two nurses with the apparatus in position. In one case the Extra-Aural block tin pads are in position; in the other the Extra-Aural block tin pads have been removed. The block tin is of about four square inches surface in shape quite similar to a horseshoe and slips up and about the auricle, back, below and in front, contacting accurately. It is adjusted on spring wires so that the pressure is applied at four points on the block tin surface thus fixing it quite firmly against the skin. Four hundred milliamperes are used during that part of the treatment in which the block tin pads are in service, and after their removal somewhere nearly one hundred milliamperes of current is applied.

The essential parts are held in position by a radio head band to which has been attached those parts of the electrode which contact with the skin about the auricle and with the meatal electrode. There is a point of insulation in the bakelite blocks through which the meatal applicator passes. The spring wire supporting the metal pads are anchored to the meatal applicator shafts. The cords connect from underneath, the application is quickly made and it is found to be very serviceable.

I suspect you will find no means by which you will influence otosclerosis unless it be in the very beginning; you may be justified perhaps, in hoping to stop the advance of that very annoying trouble, but rule out your established cases of otosclerosis for treatment will not help them. If you find that you have favorably influenced a case of otosclerosis, you can put it down as an error in your diagnosis. The Richardson treatment, that is the treat-

ment by the x ray, is used in those cases which improve tardily and is found to be helpful. Dr. Richardson of Washington has done a great deal of work in this particular field; he is a very careful observer and his technique is given in detail in the literature. It is used with very great satisfaction in many of these cases. I simply did not mention it because my paper had reached the limit and I had no desire to run over the time.

Neither the age nor the duration determines as to the probable improvement of a case. It is not often that we have an opportunity to treat a case which we have turned down repeatedly with the suggestion that nothing can be done to improve their hearing. But yesterday there came into my office a lady that I treated ten years ago, with suggestion to her at the time that I might be able to check the rapid advancement of the condition that was impairing her hearing greatly. I had occasion to treat her again three years ago, with the hope that I might still retard the steady advance which the condition was making. Three years ago, she could not hear the spoken voice in the right ear. At that time no one ever attempted to speak to her in the right ear. At the left they would speak with the mouth close to the ear.

Three weeks ago she desired treatments again, for she believed that I had retarded the advance by former treatments. I put her under daily treatments, such as described above.

Yesterday, her lady friend, said, "I have a surprise for you." I thought she was going to give me some flowers, but she walked up to this lady's right ear and said, "did you know that yesterday was Armistice Day?" She promptly replied, "Yes, I knew it was Armistice Day." She had heard no voice with that ear for several years. She now heard the lady's voice fifteen inches from the left ear. She carried on a conversation with the patient that I had twice condemned to no relief after careful examination, and still after three weeks of treatment, such as is outlined here, she comes up with this noticeable relief.

I thank you.

Diathermia*

LEO C. DONNELLY, M. D.,
Detroit, Mich.

DIATHERMIA is the passage of a high frequency electric current through the human body resulting in the production of heat. If the results obtained are due to heat and heat only, then we must alter our conception of the changes that heat will produce when generated within the tissues. Perhaps these changes are due to heat plus some electrical reaction. Diathermia differs essentially from other forms of heat in that it is generated within the tissues and can be absolutely controlled, both as to intensity and to location of greatest heat, by varying the intensity of current and size and location of electrodes.

A diathermia machine is simply a broadcasting (wireless telegraphy) machine, varying the wave length and consequently the frequency varies the type of current. Apparently a frequency of 840,000 to 850,000 per second creates the greatest heat. Whether this current will be the best for autocondensation, remains to be proven by clinical experience.

Diathermia machines are used for heat and vascular dilatation.

If the monopolar connection is used and the heat is concentrated at a point sufficient to dehydrate the tissue, dessication or fulguration results. The doctor may either directly spark from the electrode to the patient, or place the patient on an autocondensation pad, or allow the patient to hold a handle or suitable electrode, connected to the monopolar outlet on the machine. The doctor then draws the current out by directly applying the electrode to the diseased part, placing his fingers on the body as a rheostat, and removing a sufficient number of fingers to regulate the heat. A foot switch can be used very handily, flashing the current after the electrode is properly placed for this technique and also in electrocoagulation.

Electrocoagulation is produced by using the two pole connections, having a large indifferent or neutral electrode to dissipate the heat from one pole and a small pointed electrode concentrating the heat to a sufficient temperature to coagulate the diseased tissues. Sufficient heat to coagulate a piece of raw meat of the dimensions of the diseased tissues to be

coagulated determines the amount of heat used.

Electrocoagulation is painful and requires local, nitrous oxide gas, ether or chloroform anesthesia. The heat generated will ignite oxygen or ether. If either are used they must be removed before beginning electrocoagulation. I have found nitrous oxide gas satisfactory, allowing the patient to breathe an occasional breath of air to insure proper oxygen content.

Fulguration and electrocoagulation are surgical procedures requiring strict attention to details. It is bloodless, sterilizes and produces a dam of small round cell lymphocytes which limits the absorption of the toxic products.

When larger electrodes are used with less concentration of current per square inch, medical diathermia results. Medical diathermia refers to the heat generated within the tissue sufficient to bring about increased physiological and chemical changes, without destruction of tissue. Increasing the heat of a part produces increased chemical or metabolic changes. Whatever the function of the part treated, that function will be increased. Medical diathermia is therefore indicated in any condition in which increased function of any part is desired. The function of an organ differs according to the condition under which that organ is working. For example, the periosteum of bone at times is so injured that it will not throw out sufficient callus to produce union following a fracture. Diathermia will so stimulate the periosteum, that it tends to perform its normal function and increased callus results. After there has been excessive callus production and fibroid degeneration about an old fracture, medical diathermia tends to increase chemical or metabolic changes, tending to restore the part to normal. In this instance absorption of excessive callus and fibrous tissue results. In other words the same current will tend to produce callus or to absorb callus, depending upon this basic principal. The natural body influences will direct this chemical change along paths most needed at that particular time, and in that particular part of the body.

The increased heat may produce the vasodilatation or it may be due to some electrical

*Read at X Ray, Radium and Physiotherapy meeting, Omaha, Nebr., Jan. 5, 1925.

phenomena. If the increased heat produces the vasodilatation, there is no need for a separate classification of vasodilatation as an indication for diathermia. Any part of the body that will be benefited by an increased blood supply or increased heat, will be benefited by diathermia. In many instances, both factors are required to correct pathology present in the disease.

In many infections it is advisable to raise the temperature of the part to such a degree of heat that the germs will be killed. For an example, in gonorrheal endocervicitis, a special electrode, such as the Corbus cervical electrode, containing a thermometer, is placed in the cervix and large indifferent electrodes are placed over the abdomen and under the back, using a bifurcated cord. The pelvic contents are heated, the greatest intensity being in the cervix. The entire blood stream could be heated by using the autocondensation pad as the indifferent electrode. After the infection has spread and involves the vagina, vulva and contiguous parts, a mesh covered moist sponge may be forced against the vulva for the active electrode. Theoretically, this treatment should cure gonorrhoea with one treatment. In my hands it has been of great value, but I have cured no case in one treatment. Both diathermia and ultraviolet light treatments can often be given at the same time.

With increased heat and increased vasodilatation, increased elimination necessarily results, consequently conditions associated with toxemia or acidosis are benefited with diathermia. High blood pressure with or without arteriosclerosis is benefited. Hardened arteries can be softened with diathermia, but it is dangerous to give prolonged heavy treatments. There is so much waste matter broken down and eliminated into the bowels as well as through the skin that a patient may reabsorb his own toxins unless plenty of water and an occasional alkaline cathartic is given. When using diathermia, or in fact any treatment in the care of the sick, it seems rational to give the most nutritious foods and to pay strict attention to elimination. Whole grains, fresh ripe fruits, milk and milk products, raw and cooked vegetables, especially the leafy vegetables, nuts and a moderate amount of meat, apparently are the best foods. This diet insures plenty of mineral salts and vitamins as well as the proper balance of protein, carbohydrates and fat.

Increased heat and increased blood supply aid in dissolving fibrous tissue. Recently I

have x rayed a patient who has clinically had tuberculosis for a number of years. She has had sanitarium treatment and passed through the hands of several doctors, all of whom concurred in the diagnosis of tuberculosis. Following several months of rather intensive ultraviolet irradiations and diathermia through the lungs there was marked improvement in general health. A recent stereoscopic chest examination reveals practically no evidence of her ever having had tuberculosis. Perhaps all of her previous physicians, including myself, have been mistaken or perhaps ultraviolet energy and diathermia have cured and greatly aided in removing the vestiges of the tuberculous diseases. Happily the patient gives my services the greater part of the credit for her improvement.

All of the text books and instructors inform us that diathermia should not be used where there is danger of hemorrhage. I have inquired of several other users of diathermia if they personally have produced hemorrhages, and none have. In cases such as gastric or duodenal ulcer I have used intensive doses of diathermia. In no case have I apparently done harm. In the majority of cases I apparently have done good. I realize that if an ill result would occur that all authorities would be against me and that I would have a very poor show in a malpractice suit before a jury.

All authorities inform us that we should not use diathermia where there is confined pus. If possible, and it is always possible, drain first. In many instances, such as pyosalpinx, the woman does not desire surgical interference. I have repeatedly given small doses of diathermia with intensive vaginal ultraviolet and general ultraviolet irradiations. In such cases diathermia is followed with cramps and aching, treatment being stopped as soon as aching begins. A series of these treatments apparently benefits the patient and it is offered for what little it may be worth. If the surgical results on pus tubes were always good the above treatment would have little to commend it. Unfortunately I have seen many women not improved by the surgical removal of ovaries, tubes or uterus.

DISCUSSION

Q. How would you handle an acute infantile paralysis?

A. If I had an acute case of infantile paralysis I would treat that acute case immediately. I would not wait for two or three weeks until the so-called acute stage is over.

Every hour you are waiting those cells are being damaged, and it is all the harder to bring your child back to normal. I believe you can put diathermy through the spine, greatly increasing the amount of blood, thereby producing an increased nutrition, which will surely be of benefit. I would also give that case general ultraviolet radiation.

You might have to treat extreme cases for thirty years or more, according to the degree of damage done. The patient cannot afford to go through that treatment; but he can get ultraviolet by taking his clothes off and lying

in the sun. Ultraviolet light or sunlight will bring more muscles back to normal than massage. I was talking with a fellow practitioner only recently about building up the thorax with actinic ray. "That's old stuff," he said. "In '03 I was on the rowing team with Columbia. Every noon we had to go up and lie naked in the sun for an hour."

Most of the stuff I am giving you is very old, if we only knew it.

607 Kresge Bldg.

CASE REPORTS

Advanced Hypernephroma Treated by Medical Diathermia*

WALTER B. WALLACE, M. D., and G. VAN AMBER BROWN, M. D.,
Detroit, Michigan.

MR. D. J. Mc., white, called at the office on January 27th and gave the following history. Family history is of no interest in this complaint. His age is 54 years, married, and worked as superintendent of a small number of men. He had scarlet fever when a child and was operated upon for urethral stricture about two and one-half years ago. The history was otherwise negative.

CLINICAL HISTORY

His chief complaint at the present time is blood in the urine. This made its appearance on January 24th, 1924. Previous to this date he had an ache in the back over the lower lumbar and extending over the right hip. On the above date patient urinated in a vessel and noticed that it contained blood. January 27th he consulted Dr. G. Van Amber Brown. From that time to February 3rd there has been blood in the urine, but in lessening quantities. The blood is thoroughly mixed with the urine and does not clot. Occasionally there is no

blood in the urine. The patient is compelled to arise once each night to urinate.

PHYSICAL EXAMINATION

Patient is rugged in type, has a blood pressure of 205 systolic and 120 diastolic. The right kidney lower pole lies at the level of the umbilicus. Examination of the left side reveals a mass four fingers in breadth and five fingers in length, extending from beneath the ribs to below the level of the umbilicus. The mass is irregular, nodular in some places and smooth in others. The mass moves with the excursions of the diaphragm. These findings are determined by palpation. The right border of the liver is also palpable and the reflexes are normal.

UROLOGICAL EXAMINATION

Cystoscopy shows the bladder normal in capacity and color except for pigmentation in one area due to previous medication. No attempt is made to catheterize the right ureter, but the left ureter is partially strictured at one centimeter and totally strictured at seven centimeters, so that the catheter will not pass above this point.

*Read before the Third Annual Meeting of the American College of Radiology and Physiotherapy, at Chicago, November 12, 1924.

After giving phenolsulphonephthalein there is not a trace after 20 minutes.

LABORATORY FINDINGS

Urea blood retention is determined on salivary index 94 (normal 30 to 50). Functional test results in the first hour in 200 c.c. of urine and phenolsulphonephthalein 10 per cent. In the second hour urine 225 c.c., phenolsulphonephthalein 8 per cent is passed, a total for the two hours of 425 c. c. urine and 18 per cent phenolsulphonephthalein. Specific gravity of urine is 1012, reaction is acid with a straw color and tests for albumen are positive and negative for sugar. Red blood cells are present. Blood is usually present microscopically also macroscopically and regularly mixed with the urine.

X RAY REPORT

Right kidney lower pole is visible in the roentgenogram and the kidney appears larger than normal, but no shadow exists suggesting calculi. The left kidney, lower pole, is visible. The kidney is enlarged and irregular in outline, calices are injected but are indistinct and the kidney pelvis appears larger than normal.

DIAGNOSIS

Tumor of left kidney.

PROGRESS

On March 5th, Mr. Mc. was referred to the reader of the paper by Dr. Brown for further treatment. The Doctor asked what could be done for the patient by means of physiotherapy and was told that it did not seem that there was anything encouraging to offer. Dr. Brown, who is familiar with the treatment by diathermia, said, "Well, try! He is past surgical aid." With that understanding, electrotherapy treatment was commenced. The man had the appearance of one who was very sick, the veins of the head and face were prominent, the skin had a sickly lemon tint, he was irritable, he had dizzy attacks and had given up work some time previous to consulting Dr. Brown. In fact, his appearance was that of one in a severe toxic condition.

On simple inspection this immense tumor filled the whole left side of the abdomen and at its apex bulged the anterior abdominal wall markedly. The physics of the current used, namely, the d'Arsonval, will be disregarded, except to mention the fact that the passage of a current through the tissues meets with re-

sistance and in overcoming this resistance heat is produced. It has been proven conclusively that heat has a retrograde action on tumor masses. Percy's treatment has been very effective in many inoperable cases of carcinoma. As you all know, his method has been that of using heat of a low degree applied for a long time. Dr. G. Van Amber Brown has treated many of these cases of so-called irremovable carcinoma of the uterus by the application of low degrees of heat combined with the starvation ligature, with most gratifying results.

In an article by Corbus, the statement is credited to Vidal that any successes made in the treatment of malignant tumors by the use of vaccines, toxins, etc., are due to an anaphylactic reaction following their administration—the main symptom of this reaction being an increase of temperature.

The first three treatments, using autocondensation, may be objected to on the ground of the high blood pressure being considered compensatory. However, as he was having high pressure symptoms, it was given and with beneficial results, both as to the lowering of high pressure and its symptoms.

On March 5th he received his first treatment. Previous to the treatment his blood pressure was 185 over 110. After one-half hour of autocondensation of 400 m. a. it was 160 over 90.

March 7th. The second treatment was given. Immediately previous to this treatment the systolic pressure was 175 and the diastolic was 105. The time of treatment was one-half hour of 400 m. a., and following the treatment the pressure was reduced to 160 over 95.

March 10th. Complained of severe pains in lumbar muscles of both sides and was tender to pressure in the same region. This pain and tenderness did not seem to have any reference to the tumor mass. Before treatment the pressure was 160 over 105, following autocondensation of one-half hour's duration of 400 m. a. The pressure was 160 systolic over 90 diastolic. After the autocondensation, he was treated with a large nonvacuum body electrode over the lumbar regions for a period of twenty minutes, which gave immediate relief.

March 12th. Patient received first diathermia treatment through left kidney tumor mass. Block tin electrodes were used for one-half hour at 1600 milliamperes.

March 14th. Diathermia was given through region of tumor for one-half hour, using 1200 milliamperes current.

March 17th. Patient complains of pain in lumbar region, also has tenderness in same location. At this time we used a nonvacuum body electrode over painful area with considerable relief. The tumor was somewhat smaller. Gave diathermia through the mass, one-half hour, using 1600 milliamperes.

March 21st. Diathermia given through mass one-half hour for 1600 milliamperes.

March 24th. Previous to treatment blood pressure was 158 over 100. Tumor is receding in size. Diathermia was administered through growth, one hour, for 400 milliamperes. No blood was to be found in the urine at this time.

During the interval between March 24th and May 8th an acute illness, leading to the death of his wife, prevented any further treatments. Before taking the treatments of March 24th his blood pressure was 138 over 90. For several days patient complained of fingers, face and feet tingling and nausea. Yesterday patient passed blood in the urine. Just previous to urinating, there was pain at end of penis. On urinating it looked to him as though someone had dumped a pot of brick dust in the vessel. Tumor seems slightly smaller in size than at last treatment. At this sitting, diathermia was given through the mass for 50 minutes with 1800 milliamperes.

Between the dates May 12th and May 26th, five treatments of diathermia were given, an average of one every three days, time varying from 40 minutes to one hour, milliamperage from 1700 to 2000.

On May 26th the blood pressure was 136 over 90.

Between the dates May 29th and June 16th, six treatments of diathermia were given, averaging a treatment every second day, time varying from 45 minutes to one hour, and the milliamperage varying from 1850 to 2350.

June 16th. No blood found in urine either macroscopically or microscopically.

Between the dates July 28th and August 27th, five treatments of diathermia were given, with time varying from 40 minutes to one hour and the milliamperage varying from 1700 to 1900.

On August 27th the treatment of diathermia was followed by one with the quartz air cooled lamp, time two minutes, target distance 40 inches, voltage 70. The radiation was made over the entire front and back of the body. The reason for using the quartz light was that I had already read an article by Dr. A. J. Pacini in which attention was called to the point that certain tumors grow less rapidly when the blood is high in calcium and low in potassium. Also it has been proven conclusively that the quartz light aids in producing an increase of cellular calcium content.

Sept. 4th. Gave ultraviolet treatment, air cooled lamp, time 4 minutes, target distance 40 inches, voltage 70, over entire front and back of body, followed by diathermia through the mass. Time of administration was one-half hour, using 1700 milliamperes.

Sept. 11th. Diathermia administered for one-half hour from a 1500 milliamperage current. Mass still decreasing and almost imperceptible by palpation.

Sept. 18th. Growth is still receding in size. Diathermia applied for 45 minutes, 1700 milliamperes, followed by ultraviolet, air cooled lamp, time 4 minutes, target distance 40 inches, voltage 70, to front and back of body.

October 10th. Tumor is steadily growing smaller, diathermia used for 30 minutes at 1500 milliamperes, followed by ultraviolet, air cooled lamp, time five minutes, target distance 40 inches, voltage 70, to front and back of entire body.

November 6th. Following cystoscopy with a catheter in the left ureter, very little urine was excreted from the kidney. Phenolsulphonaphthalein output from this side was in 14 minutes nil and was less than 1 per cent at end of half hour. At this time the patient was examined by several physicians, including one of the writers, and none were able, by manual examination, to find any evidence of the tumor. The x ray showed an enlarged kidney, but no additional mass.

CONCLUSION

In closing I want to emphasize the fact that the clinical picture as given does not adequately bring to you the condition of this patient when he first came to our clinic. Let me again picture to you this man with the veins of his head and face engorged, and the skin a lemon tint. He was irritable, had dizzy spells, was weak and there was loss of weight

and a systolic pressure of 205. He had, for some time before beginning treatment, been unable to do any work, in fact, was wholly incapacitated. The tumor mass filled the whole left side of the abdomen, the patient as a whole presenting a most discouraging problem. While in the diseased kidney functional end results are practically nil, the right kidney has compensated to such an extent as to give a normal urinary output as shown from time to time by a careful urinalysis. The patient has gained in weight, his cheeks are ruddy, blood pressure is down to within limits of normal and he says he feels well. He certainly looks well and for some time has been following his vocation.

This case has not been reported as a cure nor with the idea of supplanting surgery in operable cases, by diathermia, any more than we would wish to supplant surgery in a case of appendicitis. However, the object of this report is to stimulate a further trial of this treatment in inoperable cases, giving to the sufferer a chance for relief without toxemia as one of the results and without doing damage to any of the other tissues, both of which are prone to follow certain other methods of treatment, added to all of which is the hope of cure. Woodward Clinic,

13300 Woodward Ave.

EDITORIAL

The JOURNAL OF RADIOLOGY

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A. F. TYLER, M. D.
Managing Editor

Call for Papers

THE program committee wishes all the members of the College who desire to appear on the program at the annual meeting to send in titles at once. Cooperation of the members in this matter will greatly aid the early arrangement of the program. It is desired that the following subjects be represented in their various phases:

X Ray Diagnosis, X Ray Therapy of Skin Lesions, X Ray Therapy of Deep Seated Lesions, Radium Therapy, Ultraviolet in Pedi-

atrics, Ultraviolet in Pulmonary Tuberculosis, Ultraviolet in Nontuberculous Diseases of the Lungs, Surgical Diathermy in Benign Lesions, Surgical Diathermy in Carcinoma, Medical Diathermy in Gynecology, Medical Diathermy in Bone and Joint Diseases, Medical Diathermy in Traumatic Injuries, Galvanism in Gynecology, Galvanism in Proctology, Galvanism in the Treatment of Sinuses and Fistulae, The Sine Wave Current in Medicine, The Uses of the Static Current in Medicine, Heliotherapy in Medicine, The Physics of Ultraviolet, The Physics of High Frequency Currents, The Physics of the Sine Wave Current, The Physics of the Static Current, The Physics of the Galvanic Current, The Physics of X Ray and Radium, The Pathology of Carcinoma of Various Types, Pathology of Bone Tumors, Pathology of Pulmonary Tuberculosis, Pathology of Nontuberculous Diseases of the Lungs, Instruction in Physiotherapy for Technicians and Aides, Medical Students and Medical Graduates.

It is hoped that the above list of subjects may aid the members of the College in stimulating thought in choosing the subject for the paper to be presented. This list is used only as a suggestion and is not claimed to be complete. Other subjects will naturally occur

to various individuals and will be gladly received by the program committee.

Send in titles at once to the secretary, Dr. R. W. Fouts, 121 S. 33rd St., Omaha, Nebraska.

Program Committee

A. R. HOLLENDER, M. D.,

JAMES C. ELSOM, M. D.,

R. W. FOUTS, M. D.

PRESIDENT POPE has appointed the above members of the Program Committee, who have the responsibility of preparing the program for the Annual Meeting. Work already is under way and a valuable program is assured. The committee plans to arrange the program so that every branch of physical therapy will be represented.



Curran Pope, M. D.

AT the Third Annual meeting of the American College of Radiology and Physiotherapy held in Chicago, November 12-14, 1924, Curran Pope, M. D., of Louisville, Kentucky, was elected its President for the ensuing year. Dr. Pope follows his chosen profession at Louisville, specializing in Neurology, Internal Medicine and Physical Therapeutics.

Dr. Curran Pope was born in Louisville, Ky., November 12, 1866, the son of Judge Al-

fred Thruston Pope, and Mary Tyler Pope—daughter of Col. Curran Pope. After graduating from the public schools of Louisville and the Rugby Private School, he received the degree of Doctor of Medicine from the University of Louisville medical department in 1889. He supplemented his preparation with two years postgraduate work in America and abroad. Study was resumed at the New York Polyclinic and Post Graduate Schools in 1889, only to be continued by postgraduate courses in London, Paris, Vienna, Berlin, and Frankfurt-on-the-Main during the year 1890.

Returning from this extensive preparatory study, Dr. Pope assumed the position of Resident Physician for the Central State Hospital, only to be recognized and appointed as Lecturer on Pathology, Bacteriology and Microscopy at the Hospital College of Medicine for the years 1892-94. In the following year, 1895, Dr. Pope became Professor of Neurology and Psychiatry at the Louisville College of Medicine, retaining this position until 1899, at which time he resigned only to receive the appointment of Adjunct Professor of Neurology, Psychiatry and Physiotherapy for the Kentucky School of Medicine during 1902-08. For the years 1909-10, he served in the physiotherapy department of the University of Louisville. He was the first to teach physiotherapy in the South.

Dr. Pope is one of the earliest pioneers in the field of Hydrotherapy, Mechanotherapy, Electrotherapy, and physical measures in the South. At present he is Medical Director of the Pope Sanatorium, is visiting Neurologist and Physiotherapist at St. Anthony's Hospital, and has acted as consulting Neurologist and Lecturer for the Louisville Public Hospital for the past twenty-five years. He also occupies the positions of Associate Editor of the American Journal of Electrotherapeutics and Radiology, New York, Associate Editor of the Indianapolis Medical Journal, Associate Editor of the American Journal of Physical Therapy and Associate Editor of the Archives of Hydrology, London, England. Dr. Pope has occupied the position of State Delegate from Kentucky to the American Medical Association for a number of years, and has recently been appointed by Governor Fields of Kentucky as Commissioner of the Board of Charities and Corrections, 1924-28.

Among the medical and scientific societies with which Dr. Pope is affiliated are the American Medical Association, American College of Radiology and Physiotherapy, Kentucky State

Medical Association, Jefferson County Medical Society, American Electrotherapeutic Association, American Psycho-analytic Association, American Medico-Psychologic Association, American Association for Clinical Research, American Association of Internal Medicine, American Congress of Internal Medicine, American Association for the Advancement of Science, Southern Medical Association, Mississippi Valley Medical Association, Ohio Valley Medical Association, Western Physiotherapeutic Association, International Society of Medical Hydrology (London), National Geographic Association, American Academy of Physiotherapy, Louisville Society of Medicine and Surgery.

Fraternally, Dr. Pope is a Mason, Knight Templar, Shriner, a member of the Order of the Eastern Star, an Elk, and a Phi Chi of the national medical fraternity.

Dr. Pope has been exceedingly active in many medical associations, constantly striving towards the advancement of the medical profession. He is recognized as one of the continent's outstanding authorities on the therapeutic application of electrotherapy and physiotherapy, having published "Practical Hydrotherapy," and contributed numerous articles and many editorials to the leading medical journals of this country.

Dr. Pope is actively occupied as Medical Director of the Pope Sanatorium, 115 W. Chestnut St., Louisville, Kentucky.

Aims and Purposes of the College*

IT has been said "to become proficient in the practice of medicine, it is necessary to *practice* medicine." Along this same line, it may be said, in order to be a physiotherapist one must *practice* physiotherapy.

Physiotherapy is that branch of medicine which deals in physical and nature's methods.

It is obvious that nature has provided a definite method governing growth, reproduction, repair and decay of all animate and probably inanimate matter. The higher the order of life the more delicate and important the mechanism. It is cheering in a high degree that we, as physicians, are progressing well toward the solution of nature's problems.

*Presidential address delivered before the Third Annual Meeting of the American College of Radiology and Physiotherapy, Chicago, Nov. 12, 1924.

The electron theory of matter has given us an intelligent basis from which we hope to work out many of nature's mysteries.

The road of investigation of the genesis of life heretofore has ended in that slimy substance called protoplasm, but day by day, the prospects are growing brighter for the successful interpretation of nature's methods. This labor must be delegated to those men who are burning the scientific candle to the wick; and, without grudge or grumbling, let us lend all possible aid to these men that truth and truth alone shall prevail.

To sponsor and promote scientific research—to elevate the standard of physical methods in medicine—to foster and promote the progress of the sciences of radiology and physiotherapy—to disseminate knowledge in the fundamentals governing these sciences—to facilitate and insure their correct application—to form a more perfect union of allied societies—to insure tranquility in the profession—to establish professional justice—to promote friendly intercourse, and above all, to alleviate human suffering—to fulfill these obligations was born the American College of Radiology and Physiotherapy. This society is an expression of our desire for better applications of methods by which practical effects may be given the principles for which we stand. It is our intention by every means in our power, to insure its practical efficiency. It is our firm belief that through its instrumentality we can hope to become better physicians.

The work of this College has now assumed a definite character and will have that particular force, which should be associated with our work.

If we are to come up to the standard of what is expected of us, we must be alert to grasp every opportunity which presents itself for our advancement.

It is the desire of the organizers of this society that it shall be one of high standing and scientific value and to that end it must have standard requirements of the highest order.

CURRAN POPE, M. D.

Paramount Therapeutics

MEDICINE is not included among the sciences, but the discoveries made during the forty years just past have made its application a science, and if an equal advancement be made during the coming forty years

it will occupy a high position among the sciences.

Medicine is the greatest and grandest work ever placed in the hands of man to develop. We are ever seeking new aids to advance our work.

Since the dawn of civilization man has employed various methods to accomplish results; this is true not only in commercial life, but in medicine. Nevertheless, in doing a thing, whether it be in building a highway or treating the sick, there is always a way paramount to all others.

In speaking of paramount therapy, it may be well to compare methods of bygone days with those in practice today, and I beg your indulgence while I refer to some of the methods employed at different periods of medical history.

A knowledge of that which is lamentable in the past serves us well in meeting the emergencies of the future.

Hoang-ty, 2500 years before the Christian Era, described syphilis as consisting of three stages, and that the disease is transmissible to children who are unborn; that the snuffles in children is a symptom of inherited syphilis. He also referred to bone syphilis which makes the victim's life miserable.

Notwithstanding the discovery of "606" by Erlich, mercury has been the paramount treatment of syphilis for more than 200 years.

Three thousand years ago the Chinese treated scabies with sulphur.

WHAT OF ASEPSIS?

Hippocrates, the father of medicine, who died about 320 years prior to the Christian Era, was a descendant of a long line of medical men. His father left him, as an inheritance, a hospital known as the Temple of Cos. Hospitals in those days were known as Temples of Health, and were built in the most salubrious places. Before a patient was admitted to the hospital he was given a cleansing bath, a shampoo, and a massage of the entire body. This was followed by a fomentation of odiferous herbs, then he was placed upon a strict diet in accordance with the instructions of Hippocrates. A complete record was kept of each patient. Many of these records were lost by fire when the Alexandrian Library was destroyed.

Hippocrates' familiarity with the spine and spinal nerves would make a chiropractor of

today green with envy. He was well posted in orthopaedic surgery and treated many cases at the Temple.

WHAT OF SURGERY?

Hippocrates operated upon the skull with a trephine, opened the chest in empyema and hydrothorax. His work on simple fractures was excellent. He may have had some knowledge of the ductless glands as he wrote of the ability of an organ to suck or attract humidity from others. He taught that diseases were cured by similars. Here is where homeopathy got its tip, "*Similia similibus curantur.*" He treated inflammatory affections with cups and venesection. His narcotics were mandragora, henbane, and poppy juice.

While internal cancer was left severely alone, when superficial it was operated with knife and cautery. He considered phthisis contagious. He thought that urinary calculi were caused by bad water, and his description of stone in the bladder is as lucid as that of recent writers on the subject.

He used a vaginal speculum in making examinations of women and treated uterine disorders with vaginal suppositories. There is no record of the use of the "*whirling spray*," but it is quite probable that he had something just as good.

From the earliest times enemas were given with an improvised syringe constructed from the bladder of some animal tied over the end of a wood tube.

WHAT OF ENDOCRINES?

At least 3000 years ago the Chinese used a combination of stag's brain and bone marrow as an aphrodisiac.

In "ye olden tyme" the paramount therapy for bald pates was the following: Take of mice dung a small quantity, a few pinches of ashes of burnt wasps, a few burnt hazel nuts and make an ointment with vinegar of roses. Apply freely to the scalp. Almost equally efficient remedies are paramount today.

It is indeed interesting, in the writings of men of ancient times, to note the frequent display of common sense in the description of disease and its treatment. We cannot help but marvel at their practical medical knowledge and their ability to apply it at the bedside.

In those days many believed in incantations. No less than Galen himself believed in conjurations. Quintus Serenus Samonicus wrote a

book on *materia medica* in which he advised the wearing of amulets to charm away intermittent fever.

That disease may be cured in some supernatural manner, somehow or other, exists in the minds of a large majority of our people.

Hope springs eternal in the breast of every victim of disease, and makes him easy prey for the quack.

For many centuries diseased conditions were treated by appeals to the supernatural and we have by no means relieved ourselves of the incubus.

Every celestial body moves in a circle and the habits of man are no exception. For a time man rushes into the city, then to the country and back again to the city. Investments are made in industries, in mining, in lands and back again to complete the circle. The wheel of medicine turns in the same manner. When it returns it may have new clothing, be cleaner shaven, but on close inspection it will be found to be the same old thing. In the language of Walt Mason, "*We sit and chew the same old rags and spring again the same old gags.*"

Does Mary Baker Eddy's Science and Health teach anything that was not known to the ancients? For many centuries prior to the Christian Era the same *flapdoodle* was paramount therapy.

The therapy of the first half of the 19th century may be summed up in the words of a poet of that age:

"When people's ill, they come to I,
I physics, bleeds and sweats 'em;
Sometimes they live, sometimes they die,
What's that to I? I lets 'em."

—JOHN LETTSOM.

Of venesection, physics, emetics, clysters, and blisters the laity became tired. Like the pendulum they went to the other extreme and for a time infinitesimals became the paramount therapy.

"The ninety-ninth dilution
Of a pellet in solution—
It will hasten resolution,
In a very wondrous way;
While the millionth trituration
Of a certain preparation
Will complete his restoration
At a very early day."

—S. F. BENNETT.

A little later on pelvic surgery became quite popular. The physician who could not spay a woman in fifteen minutes was a back number.

Later on typhlitis gave way to appendicitis.

"Have you got the new disorder?

If you haven't 'tis in order

To succumb to it at once without delay.

It is called appendicitis,

Very different from gastritis

Or the common trash diseases of the day.

"Midway down in your intestine,

Its interstices infest in',

Is a little alley, blind and dark as night.

Leading off to simply nowhere,

Catching all stray things that go there;

As a pocket it is simply out of sight."

—ANON.

Early in the eighties came the discovery of the coccus and the bacillus, one after another in rapid succession. Antiseptic surgery so popular at the time was soon followed by aseptic surgery and the cry "cut it out" was paramount.

The discovery of antitoxins and bacterins compelled surgery to divide honors.

WHAT OF TODAY?

The tendency these days is toward other agencies than drugs in therapeutics, among which may be mentioned vibration, radiant light, ultraviolet and roentgen rays and electric currents.

The discoveries of d'Arsonval, Tesla and Roentgen have made possible the paramount therapy of today.

Due solely to its efficiency, the high frequency current has taken first place in the therapy of cardiovascular affections.

In the history of medicine covering thousands of years there is no record of any claim being made for any measure, other than hygiene, that would retard sclerosis of arteries. We have proven beyond a shadow of doubt that the progress of arteriosclerosis cannot only be stopped, but in many cases much arterial resiliency can be restored. There is no known measure in medicine other than the high frequency current that will so efficiently reduce high arterial tension, relieve the pangs of angina pectoris, restore kidney function, nourish a failing heart, regulate cardiac rhythm, modify the course of pneumonia, relieve myalgias, neuralgias, and neuritides; modify nasal drainage, shrink enlarged tonsils, relieve dys-

menorrhoea, clean up ulcers, destroy benign and malignant growths, shorten the disability period following fractures, sprains and bruises, improve the condition of a tuberculous kidney, cure hemorrhoids and restore the faith of the physician in medicine.

Drugs, diet, and physical therapy all have an appropriate place in medicine and they should work harmoniously with one another for the benefit of mankind.

B. B. GROVER, M. D.

International Congress of Radiology

THE International Congress of Radiology will hold a preliminary meeting under the leadership of the President of the Congress, C. Thurstan Holland, D. L., Ch. M., in London, July 1-4, 1925. The Congress will be international in character inasmuch as radiologists from every country are cordially invited to take part. Every radiological and electrotherapeutic society is especially invited to send approved representatives who shall be eligible to serve on the International Committee.

The object of this preliminary meeting is primarily the organization of an International Congress and to bring together radiologists from all parts of the world to discuss subjects of interest, and to secure the formation of a comprehensive International Committee and *the establishment of a full International Congress to be held at stated intervals in different countries.* It is the desire of the organizing committee that at this London meeting arrangements will be made for the First International Congress, and that the date, and the country in which it will be held will be decided upon by the International Committee.

On the evening of Tuesday, June 30th, a reception will be held so that delegates and members may have the opportunity of meeting before the opening of the Congress.

The opening meeting of the Congress will take place on the morning of Wednesday, July 1st, 1925, and the other sessions will extend

over that and the following days, ending Saturday, July 4th. In the following week arrangements will be made for visits to other centers of interest.

All papers intended to be read at the Congress must be sent to the Secretary General, at the British Institute of Radiology, not later than May 1st, accompanied by a short abstract. It is particularly desirable that papers should, wherever possible, be approved by a recognized society of which the author is a member. All papers and abstracts must be typewritten or printed, and English translations will be much appreciated. Authors will be notified of acceptance or otherwise of their papers as soon as possible after their receipt. Each paper read at the Congress will be in the language selected by the author.

Arrangements are being made through an agency, for travelling facilities and hotel accommodation. Particulars will be sent on application to the secretaries.

It is hoped that all who wish to attend the Congress will signify their intention as soon as possible so that some estimate may be made of the numbers attending.

The house of the British Institute of Radiology will be used as the administrative center for the Congress. An information bureau with interpreters will be provided.

All communications should be addressed to The Secretaries, International Congress of Radiology, care of The British Institute of Radiology, 32 Welbeck Street, London, W. 1.

The Army Medical Center, Washington, D. C.

GRADUATION exercises of the Army Medical School, Army Veterinary School, and Army Dental School were held Tuesday afternoon, February 10th, 1925, in the Red Cross House, of the Army Medical Center, Washington. At this time, thirty-three candidates graduated from the Army Medical School, ten from the Army Veterinary School, and seven from the Army Dental School.

ABSTRACTS *and* REVIEWS

Experiences in the Permanency of Radiological Cure in Cancer. GOSTA FORSSELL, M. D., Am. J. Roentgenol., 12:301-311, October, 1924.

THE following data is taken from the records of the Radiumhemmet in Stockholm. In order to study the permanency of the cure, the author chose only those cases of skin and lip cancer where the treatment started five to thirteen years ago.

Cancers of the skin are divided into two main groups: the superficial tumors are those restricted to the skin and subcutaneous tissues and are freely movable against the subjacent tissue; and infiltrating tumors, which are fixed to the subjacent tissue. Of the 102 superficial tumors, a cure has been obtained in 88 cases, or 86.3 per cent of the entire group. If the nine cases which disappeared before the treatment was completed are excluded, the result will increase to 95 per cent. In the infiltrating tumors, on the other hand, the ratio of cure is only 51.4 per cent, or 54 out of 105 patients, if all cases are counted. If only operable cases are taken into consideration, a ratio of 67.5 per cent, or 54 out of 80 infiltrating tumors. Considering all the cases of skin cancer, both the entirely inoperable ones and those which have not fulfilled their treatment, the absolute ratio of cure will be 68.6 per cent, since 142 out of the 207 patients have remained cured. The topographical position of the tumor is a determining factor for the prognosis, at least as far as the infiltrating tumors are concerned.

In reporting the results of the treatment of cancers of the lower lip, the author made the same generalized classification. Out of the 40 cases of superficial tumors, 36, or 90 per cent, of the entire group have remained cured. Only in nine of 26 cases of infiltrating tumors, or 34 per cent, was there a permanent cure. Of these 26 cases, however, 14 were inoperable from the beginning. If these are not considered, the ratio of cure in the infiltrating but technically operable tumors is 75 per cent.

Of the 20 cases of cancer of the upper lip, 11 superficial cases have all remained healed, while of the 9 infiltrated cases, most of which are in the advanced stage, 3 remain healed.

As to tissue reaction to radiation, it is generally supposed that the spino-cellular carcinoma shows a greater radiosensibility than the squamous-celled carcinoma. This agrees with the observations made by the author.

In considering the differences in the results of cure in primary tumors and in recurrences following surgical operation, the author observes that both in cancer of the face and in cancer of the lower lip the superficial recurrences following the surgical intervention are cured to the same extent as are primary tumors. On the other hand, recurrences which are growing infiltratively have a much poorer prognosis than primary tumors of a similar kind.

In cancer of the lip, an important risk occurs, which, in cases of skin cancer as a rule, appears only in the final stages of the disease, namely the glandular metastases. In cases with obviously cancerous regional glands, a combined surgical and radiotherapeutic treatment has been carried out. In a majority of the cases treated in this manner, all remain free from symptoms, but the period of observation is still too short to permit any definite conclusion.

In considering the duration of the cure in all cases of skin cancer cured between 1910 and 1915, it is noted that 76 cases in all, or 53.5 per cent, have been observed cured from five to fifteen years. In 29 cases, or 20.5 per cent, the cure has been observed from two to four years. In 37 cases, or 26 per cent, the period of cure has been verified only during one year or less.

Examining the frequency of the recurrences following radiological cure, of the 156 cases of skin cancer, in which a radium cure has been accomplished during the period from 1910 to 1915, 32 cases, or 20.5 per cent, have had a recurrence. Only 11 cases, or 12 per cent, of the 92 cases of superficial growths have displayed recurrences. In infiltrating tumors, recurrences have developed in 21 cases, or 33 per cent, of the 64 have been cured. Twenty of these cases have had recurrences within the original cancer area.

Out of the 18 cases of superficial radium recurrences which have been given repeated ra-

dium treatments of the radium recurrences, 11 cases, or 60 per cent, have been permanently cured by repeated treatment. Thus, the ratio of cure in radium recurrences is considerably lower than in primary tumors, in which about 90 per cent of cure was obtained.

Judging from this experience, the author considers that the permanency of cure obtained by radium therapy in cancer of the skin and lower lip is quite comparable to that of surgical intervention.

A comparison between the results noted in the cases treated with radium alone, and the results obtained at other institutions where roentgen treatment only or a combined radium-roentgen therapy has been used convinces the author that the treatment with radium alone, as a rule, is to be preferred in carcinoma of the cervix where there is no extensive glandular metastases. The writer looks upon a radium treatment as being preferable to a roentgen treatment in circumscribed malignant tumors, if the tumor is accessible for a direct and sufficient irradiation with radium. The chief reason for this is the comparatively limited effect of the radium radiation, which is neither attended with the same amount of risk to the surrounding tissue, nor has the same injurious effect on the whole individual, as has the deep roentgen radiation. In the treatment of cavities, such as the uterus and the bladder, mouth and pharynx, radiumtherapy has also a very great advantage over roentgen treatment.

Neither in carcinomata nor in sarcomata is the success of radiotherapy in malignant growths principally determined by the radiosensitivity of the characteristic cell type.

Rapid growth of the tumor possibly renders it more radiosensitive, though less curable. On the other hand, a tumor of but little radiosensitivity, as the squamous-cell carcinoma, is, as a rule, cured permanently by a fully satisfactory technique, if it is still local and confined to the soft parts. The biological character of the tumor and its stage of development determine the final result to at least the same extent as the degree of its radiosensitivity.

The final, as well as the primary cure, mainly depends on the technique used, or rather on the skill and experience of the radiologist.

A New Kind of X Ray Examination for Preventative Dentistry. HOWARD R. RAPER, D. D. S., F. A. C. D., *International J. Ortho-*

dontia, 9:76-86, January, 1925.

IN the first number of the 1925 publication of the *International Orthodontia*, the associate editor, Dr. H. R. Raper, begins a series of articles dealing with the greatest problem in dental surgery—the prevention of pulpless teeth. In a preliminary discussion, the progress of dental disease is discussed and illustrated graphically, and the relation of death to disease discussed from the dentist's point of view. "The recent cleanup of septic mouths in America hung on the peg of the general x ray examination.....and.....the future preventative dentistry will, I believe, also hang on an x ray peg. It is this peg that I wish to show you and describe to you here; it is an interproximal examination made radiographically." With this point in view, the author describes the need of radiographic interproximal examinations and the nature of these examinations.

Conservation of Normal Tissue After Treatment With Radium. DOUGLASS W. MONTGOMERY, M. D., and GEORGE D. CULVER, M. D., *Am. J. Roentgenol.*, 12:526-527, December, 1924.

IN epithelioma of the face there is grave danger not only in altering the psychical effect, but also in producing an anatomical alteration. In epithelioma of the wing of the nose, there is danger of a perforation into the nasal cavity, or of the entire wing breaking down, or of healing with an unsightly deformity. Any procedure that obviates these disadvantages must evidently be of importance. Treatment by roentgen rays or by the gamma rays of radium provides such a means.

There is no more wonderful development of therapeutics than the selective lethal action of the very fine undulations emanating from radium or from a roentgen tube, upon certain types of cells. The malignant cells of many epitheliomata, especially those situated on the nose or in the neighborhood of the eyes, are exceptionally sensitive to these undulations, and it is fortunate that they are so, as by their use the infiltrating cells may often be eliminated, and the normal tissue left *in situ*, thus reducing the scarring and deformity to a minimum.

The Action of Buried Glass Capillaries of Radium Emanation on Plant and Animal Tissues. ISAAC LEVIN, M. D., and MICHAEL LEVINE, Ph. D., *J. A. M. A.*, 83:1645-1650.

THE intratumoral insertion of bare capillary glass tubes of radium emanation presents

today the best single method of radiotherapy in various types of carcinoma and sarcoma for the following reasons:

1. It allows an even distribution of small quantities of radiations throughout the tumor.

2. On account of the intimate contact of the radio-active substance with the tumor cells, the total amounts are small, and local results are obtained without any general effect on the organism.

3. Use is made of the beta rays, which do not act as a simple caustic agent, but destroy the nearest cancer cells and at the same time create secondary gamma or roentgen rays in the tissues; and, by the aid of these, influence the cancer cells situated at a greater distance, in a manner analagous to the action of the gamma rays of radium and roentgen rays.

While it is true that to date the best results in cancer therapy are obtained by the proper coordination between surgery and all methods of radiotherapy, it is imperative that more experimental work be done on the biologic action of the beta rays of radium.

A Brief Analysis of Some Important Factors in the Biological Action of Radiation. GIOACCHINO FAILLA, D. Sc., Am. J. Roentgenol., 12:454-464, November, 1924.

TO determine the skin erythema doses for a radium applicator using different filters, there are two main biological considerations involved: (a) The area of the skin surface irradiated may exert an influence on the production of erythema, even if the amount of radiation for each square centimeter of skin is the same. (b) A variation of the size or distance of the applicator may vary the quality of the radiation reaching the skin. There are many minor points involved, but the idea that the author wishes to convey is that the lack of an objective means to measure the intensity of the skin erythema does not prevent the solution of a good many problems related to on a quantitative basis and with as great a precision as one desires.

Some factors which may influence the susceptibility ratio between different tissues are considered in the discussion. The effect of radiation on living tissues depends upon:

1. A large number of biological factors.
2. The quality of the radiation employed.
3. The distribution of the radiation in the tissue.
4. The spacing of the radiations with respect to time.

5. The intensity of the radiation.
6. The time of exposure.
7. The quantity of the radiation absorbed for each cubic centimeter.

Gold Filter Spectrometry in X Ray Practice.

CARLOS HEUSER, M. D., Brit. J. Radiol., 29: 412-419, Nov. and Dec., 1924.

IN the practice of medicine the chief consideration in the use of any remedy for a therapeutic result is the dosage. In radiotherapy, owing to the fact that all the properties of the rays are not known, remedial treatment is constantly changing in proportion as the various properties of the rays come to be known.

By obtaining a spectrograph, the x ray practitioner can note the elements composing the ray, and can better note the biological result of each of the elements applied.

Taking the whole cone of projection of the rays, a portion of them penetrates as far as the depth of the tissues; the rest are absorbed by the tissues they pass through; some of both are reflected, and they produce in turn rays from the elements encountered. These are called the secondary rays. The secondary rays are reflected in their turn in all directions, producing tertiary rays.

According to the power of the primary ray is the force of penetration possessed by the secondary ray. If the primary has a short wave it will be able to produce waves of an equal quality; but if the primary rays are long waved they are absorbed by the tissue and have no power to produce secondary rays. The manner in which these secondary rays act upon the organism has been made the subject of study, which must be taken into account, and it can be asserted that if the primary ray has an intensity of 0.05 Angstrom units it causes the reflection of a secondary ray with a value of 0.15 Angstrom units, a fact very necessary to keep in mind in radiotherapeutics.

"The gold filter, as its spectrogram demonstrates, shows us that with it we may obtain the greatest dosage of depth with the least injury to the skin, because, as already said, all the soft rays are excluded from it, while the rays of an ascertained power of penetration pass through without causing a lesion of the skin.....

"Spectrography is the only instrument which, up to the present day, the medical practitioner holds in his hands for determining the beneficent character of the rays he applies to the patient, so that it must of necessity enter into

his daily practice if he will know the exact quality and quantity of the rays he makes use of in the course of his treatment.....

"Spectrometry has many defects ascribed to it, but it is the only exact means in our actual possession for testing the various apparatus in the market and learning at the same time the exact performance of tubes, filters, etc."

Some Important Points Relative to the Diagnosis, Manifestations and Treatment of Maxillary Sinus Disease in Adults. ROBERT E. PARRISH, M. D., Major M. C., Therap. Gazette, 49:86-90, February, 1925.

IT is the expression of the author that no examination of the nasal accessory sinuses is complete, although a careful clinical observation and transillumination have been previously studied, until a roentgenological examination has been made. Every case showing evidence of involvement of the maxillary sinuses should have roentgenograms taken of the upper teeth on the side involved. These pictures should always be taken from a definite angle, especially when the physician is taking and interpreting his own exposures. If one sinus is smaller than the other it will at the same time cast a denser shadow. A careful study should then be made pertaining to the sinus as to its size, shape, its relation to other surrounding structures, particularly the thickness of the naso-antral wall, and the relation of the floor of the nose and the teeth to the sinus floor.

Conditions other than sinusitis may be present and confuse the diagnosis, *e. g.*, nonerupted teeth, odontomas, various tumors, either malignant or nonmalignant.

In this x ray of the teeth, a careful study of their relationship to the sinus must be considered, as well as any dento-alveolar abscesses or bony absorption. A dento-alveolar abscess may rupture into the antrum and not be visible as such, but can be suspected if there is a break in the lamina dura surrounding the tooth. In such a case, sufficient clue is given for the testing of the vitality of such a tooth by the dentist, and if it is dead it should be extracted, in an effort to determine the relationship to a certain sinus.

Medical Aspects of Peptic Ulcer. GEORGE S. MATHEWS, M. D., Rhode Island M. J., 8:7-11, January, 1925.

AFTER a brief discussion of the etiology of peptic ulcer, the author diverts his atten-

tion to the problems of symptomatology and diagnosis. The most constant symptoms of peptic ulcer are at best variable, so that in general the symptomatology of peptic ulcer may be expressed as equivocal. Attempting to base one's diagnosis on such variable subjective symptoms is impractical, not to say highly impossible, with any degree of accuracy. But even the x ray has been deceiving in the mimicry of a picture of the duodenum akin to ulcer, whereas adhesions to an inflamed gall-bladder have been the cause of the deception.

Next in value to anamnesis, fluoroscopy and radiography are of the most signal help in the diagnosis of peptic ulcer. Much ridicule, and with some justice, has been heaped upon the medical man for playing fast and loose with symptoms and for classifying them in an individual case as ulcer where there may have been a reasonable doubt for its existence. Perhaps there may be cases where an x ray examination is impracticable, but wherever possible this ought to be done to aid in the diagnosis and also for the treatment that may be indicated. In the opinion of the author, "of all ancillary methods of diagnosis, one of the greatest is the assistance furnished by the expert radiographer."

The various forms of medical treatment for ulcers of the stomach and duodenum are considered by the author.

The Roentgen-Diagnosis of Diaphragmatic Hernia and Eventration. DAVID OTTOSEN, Acta Radiol., 3:509-514, December, 1924.

THE author considers it frequently possible by roentgen examination to determine and differentiate between the diaphragmatic hernia and eventration by the presence or absence of a hernial ring, the patient and the tube being variously adjusted.

The roentgenograms taken from side to side in the vertical and in the horizontal position seem especially to be of importance.

Complete Transposition of the Viscera. LEON THEODCRE LEWALD, M. D., J. A. M. A., 84:261-267, January 24, 1925.

COMPLETE transposition of the viscera, both abdominal and thoracic, is more common than generally believed, according to the contentions of the author. His statement is based upon a series of twenty-nine cases in which the transposition has been complete. This condition in no way impairs the health of the individual. It should not bar him from military service, nor should it in any way alter his status relative to life insurance.

Rotation of the heart on an axis, sometimes described as dextrocardia unassociated with transposition of the viscera, is entirely separate from transposition and is a very rare condition. In the course of this investigation the author has encountered but one case. On the other hand, retraction or displacement of the heart can always be distinguished roentgenologically from transposition or rotation of the heart.

Nonrotation of the colon should never be confused with transposition of the viscera, from which it can always be distinguished by means of a roentgenological examination. Cecum mobile is due to the excessive descent of the cecum and is frequently diagnosed as chronic appendicitis.

In the same individual, a combination of two or more of these conditions has been found to be present; for example, failure of the colon to rotate in a person with complete transposition of the viscera will leave the appendix on the right side, while the heart and stomach and spleen will also be found to be on the right side. For this reason, extreme care should be taken to so mark all roentgenograms that the right and left sides of the body can be unmistakably recognized.

Malignant Papilloma of the Kidney Pelvis.

GEORGE GILBERT SMITH and ALLAN C. GILBERT, J. Urology, 13:25-43, January, 1925.

IN the treatment of papillary tumors, the authors advocate nephrectomy, followed by complete ureterectomy. In the treatment of nonpapillary tumors, inasmuch as the carcinoma extends only by tissue continuity, the lower portion of the ureter is left after nephrectomy is accomplished. In either case, deep x ray therapy is given to eliminate all possibility of any remaining metastatic foci.

A Note on the Localization of Renal Calculi by the Aid of X Ray Films Made During Operation. WM. C. QUINBY, M. D., J. Urology, 13:59-60, January, 1925.

THE most direct and quickest exploration of the kidney is done by means of the fluoroscope, by the use of which the observer can accurately direct the surgeon to one or another portion of the kidney in which the stone lies.

Another important use of the x ray is in the exposure of the flexible films, which are wrapped in light tight paper, and held closely apposed to the kidney in much the same way as dental films are made. The film is then im-

mediately developed and serves as graphic evidence of the number and position of calculi within the organs, as well as their physical characteristics. In complicated cases several films are made; the final one should show the kidney free from all traces of shadow casting material.

Recurrent Calculi in the Urinary Tract.

FREDERICK T. LAU, M. D., J. A. M. A., 84: 272-278, Jan. 24, 1925.

BEFORE urging nephrectomy as the operation of choice, a most thorough and conservative study of the details of the calculus should be made. In the series of cases presented by the author, two of these cases had a nephrectomy done previous to their examination, one for calculi and one for hydronephrosis. In these two cases, large calculi in the remaining kidney have caused speculation on the possibility of at least a partial restoration of the functions in the sacrificed kidneys. Upon consideration of these facts, the following conclusions have been tabulated:

1. Postoperative roentgenographic examination should always be made *as a routine* before the patient leaves the hospital and at definite intervals thereafter.

2. Operative technique should include precaution against sutures acting as points of deposits of urinary salts at any point along the urinary tract, as well as all known methods to guard against left over calculi.

3. All cases should be relieved of obstruction or stasis arising from adhesions following previous laparotomies, trauma, anomalous vessels, or any condition causing pressure on the ureter.

4. The chemical composition of all removed calculi should be studied with the object in view of correcting faulty metabolism and urine reaction.

5. Most cases of obstruction and stasis may be corrected or helped by dilation of ureteral constrictions and kinks with indwelling bougies and catheters.

6. Infection should be definitely recognized as a factor in recurrence, and treated by routine lavage.

7. Foci of infection in the teeth, tonsils, prostate, and sinuses should be sought for and remedied if present.

8. Conservation should be practiced in considering nephrectomy, when there is a possibility of restoring function, particularly in cases with a history of or tendency to bilateral involvement.

Difficulties in Distinguishing Between Urinary Stones and Calcified Abdominal Glands.

ARTHUR B. CHUTE, M. D., Boston M. & S. J., 192:151-162, January 22, 1925.

THE x ray has proved so dependable a help in the recognition and location of renal and ureteral stones that the common trend of the profession is to seek its aid as soon as the question of a urinary stone arises and accept its positive findings so implicitly that occasional mistakes are made in the way of diagnosis and treatment. One must not be misled but must bear in mind that there are some conditions in which the positive x ray findings are not to be considered positive without applying certain confirmatory tests.

There are certain limitations which apply to radiology in the case of suspected stones which have been recognized for some time. These limitations apply more especially to the lower course of the ureter where a difficulty of distinguishing between a shadow of a ureteral stone and a shadow of a phlebolith, a calcified internal iliac or a calcified gland has been generally appreciated. The frequency with which shadows of calcified abdominal glands may simulate shadows of a stone in a kidney or a stone in the upper course of the ureter has been less well recognized. The case reports with the illustrations clarify the author's contentions.

In carrying out radiographic investigations on patients whose symptoms suggest the possibility of renal or ureteral stones, shadows are often found which are due to calcified abdominal glands. As a rule these shadows can be easily distinguished from urinary stones by their mottled appearance and mobility. Subsequent films find the shadows in altered positions. Occasionally the radiographic catheter, with or without stereoscopic plates, will be necessary to tell whether a given shadow is in the ureter or not. Rarely a pyelogram may be necessary to determine whether a given shadow is in a kidney pelvis or whether the shadow is extra renal. The determination of such conditions greatly alter the treatment.

Diagnosis of the Diseases of the Bladder, Ureter and Kidney, with Roentgenological Case Reports. VINCENT J. ODDO, M. D., Rhode Island, M. J., 8:1-6, January, 1925.

IN diseases of the bladder, ureter and kidney, frequent mention is made pertaining to the use of the roentgenogram in aiding or corroborating the diagnosis.

The most common and important diseases of the ureter are stricture, kinks and stones in the ureter. The less common, though just as important, are injuries, cysts, fistula and calcification of the ureter. By means of modern urologic methods, including not only cystoscopy, and catheterization, but also ureteropyelography and ordinary roentgenography, the diagnosis of these diseases can be made.

In the diagnosis of diseases of the kidney, roentgenology plays an important role. Shadows cast by tumors of the kidney aid the diagnostician. Filling the pelvis with water will show the size of the pelvis, and a pyelogram will demonstrate the size, shape and the relative position of the pelvis, and is invaluable in the diagnosis of hydronephrosis. Pyelography may also reveal pelvic deformities, polycystic kidneys, or a broadening of the calices, together with an enlargement and displacement of the pelvis as a whole. Stones in the kidney or calcification in the kidney can be diagnosed by radiography.

"You have noted, undoubtedly, that in my discussions of the diseases of the bladder, ureter and kidney, I have often referred to roentgenographic examinations. It is proper that I did so, because the roentgenography is of invaluable aid in the study of these diseases, not only for its diagnostic value and ability to verify our previous diagnosis, but also for its negative findings."

Bladder Involvement in Diverticulitis of the Sigmoid. FLETCHER H. COLBY, M. D., Boston M. & S. J., 192:4-10, January, 1925.

IT is not an uncommon occurrence in the routine examination of the gastro-intestinal tract to reveal symptomless diverticulosis. These pedunculated sacs are filled with the opaque substance and are often found by accident, when the colon is filled with the barium enema. Diverticulitis of the sigmoid can be definitely diagnosed roentgenologically when the symptoms suggest the possibility of their presence.

When fistulas occur between the bladder and the lower bowel, they are usually very small, and it is unlikely that there will be any x ray evidence of such communications. Remnants of the barium enema are sometimes passed in the urine several hours after its administration. This occurred in cases observed by the author and served in itself to verify the diagnosis of rectovesical fistula.

The Results of the Prophylactic, Postoperative, Radiological Treatment of Carcinoma of the Uterine Cervix at Radiumhemmet in Stockholm. AXEL WESTMAN, *Acta. Radiol.*, 3:502-508, December, 1924.

THE writer has made an after examination of 29 operated cases of cancer of the cervix which have gone through a prophylactic, radiological, postoperative treatment at Radiumhemmet in Stockholm within the period of 1914 to 1922. Of 12 cases that were observed for at least five years, 4 were free from recurrences. Only 6 of these cases were, however, radically operable from the beginning, whereas in the other cases the tumor was found on operation to have considerable extension. Two of these remained, nevertheless, free from recurrences. Of 6 operable cases, after-examined three years after the operation was performed, 5 were symptom free—a total of 83.3 per cent. This comparatively high percentage of cures, according to the author, corresponds to the figures of Warnekros' large statistics and might perhaps support the view that a radiological postoperative treatment should complete the operative therapy of uterine cancer.

Adenocarcinoma of the Fundus of the Uterus. S. A. CHALFANT, M. D., *Atlantic M. J.*, 28: 229-231, January, 1925.

IN cases where there is irregular bleeding near or especially after the menopause, a thorough investigation is essential. Always consider such a condition abnormal, and think of carcinoma as the possible cause.

As a rule a diagnosis of carcinoma of the fundus of the uterus cannot be made positively without curettage, or can be positively made in only a small percentage of cases.

If curettage shows malignancy, a complete and immediate hysterectomy with removal of both tubes and ovaries is recommended by the author.

Radium or x ray treatments are indicated only in advanced cases or when the patient's general condition has made the operation too hazardous. Operation after radium treatment is very difficult and bleeding is apt to be profuse and difficult to control.

The Treatment of Vaginismus by Static Electricity. BARTON C. HIRST, M. D., and J. C. HIRST, 2nd., M. D., *Am. J. Electroth. & Radiol.*, 42:443-445, December, 1924.

THE authors look upon vaginismus as merely a neurosis, and consider it extremely desirable to guard these patients against any

form of treatment which will in any way increase their nervous irritability. The employment of the static current, administered through the rectum, meets this requirement particularly well, probably by securing a relaxation of the excited and contracted muscles. The authors believe that this form of electricity also has a developmental influence, and they consider it a valuable addition to the use of the other currents which have been used heretofore.

The apparatus used in the treatment is any standard static machine with an accurate spark control. No condensing jars were used. A slow speed, giving 120 discharges per minute, with a sparkgap of from one to three inches was used. Electrodes applied were vacuum glass, using first a small rectal type in the rectum for the most severe cases, and increasing to a large vaginal electrode inserted in the vagina. The patient assumed the Sims position on an insulated couch. Treatments were given twice weekly, of from five to thirty minutes duration, particular attention being paid to the menstrual periods, and the treatments so arranged as to adequately precede and follow them as to cause no untoward symptoms. However, occasional unfavorable symptoms did appear: weakness, dizziness, faintness after treatments, together with prolonged menses with pain. As precautionary measures, all active pelvic inflammatory conditions of any sort must be excluded, and such frequent conditions as large hemorrhoids and rectal fissures, urethral caruncles, vaginitis, cervicitis, cystitis, and displacements of the pelvic viscera, must be corrected before static current treatments are begun.

Radium Treatment of Neoplasm of the Upper Air Passages. G. ALLEN ROBINSON, M. D., *J. A. M. A.*, 84:248-251, January 24, 1925.

THE observations made in this report are drawn from the results of 500 patients treated with radium during the last five years. In the opinion of the author, good results may be obtained from the application of radium only when one uses radium intelligently, with a thorough knowledge of the physics and chemistry of the subject, its biological effects, and the technique of application. It would seem probable, therefore, that the best results will be obtained only by the cooperation of the radium therapist and the skilled nose and throat surgeon.

In forty cases of angiomas of the nose, cheek and lip, uniformly good results have been obtained. As a rule, growths 2 cm. or

less in diameter are needled with small 5 mg. platinum radium needles placed 0.5 cm. apart, and allowed to remain for two hours. In the more extensive growths, surface application of gamma radiation are given in an erythema dose and repeated in from four to six weeks. In one case of cavernous angioma of the maxillary antrum, the pressure symptoms were relieved by heavy external radiation. Papillomas of the nose and tongue yield to radium successfully. Multiple papillomas of the larynx do not respond as well, because of the relative inaccessibility and the difficulty in maintaining the radium needles in place.

In twenty cases of polyps of the nose, treated during the six months, retardation of the growth and a longer freedom from recurrences has been noticed. However, the time interval is too short to permit the report of permanent results.

In cases of rhinoscleroma, three presented complete nasal obstruction due to the disease. This was relieved by radiation; in the other cases, no clinical evidence of the disease remained. The clinical diagnosis in all of these cases was confirmed by a pathological examination of the tissue.

Fibromas of the nasopharynx were found to be amenable to radium therapy.

In fifty cases of chronic tonsillitis, good results have been obtained; but, the author still favors surgical removal, when possible, as the treatment of choice.

With an intra-oral carcinoma invariably bad teeth, tobacco, or syphilis present themselves as the etiological factor. In the treatment of these cases, the oral cavity is made as sterile as possible.

In 11 cases of carcinoma of the maxillary antrum, 3 cases were markedly improved, 2 were unimproved and 6 are dead. In 10 cases of sarcoma of the antrum, 4 patients were improved, 2 were clinically free from the disease for two years, and 4 are dead.

In the treatment of malignant neoplasms of the nose and accessory sinuses, a combined radium and surgical administration is advisable. External application of 1,000 mg. hours to each of four areas at a distance of 3 cm. is given preliminary to the operation and the treatment repeated when necessary. Radical surgical removal within a few weeks plus internal radiation of 100 mg. radium for twenty-four hours is done. Both internal and external treatments are repeated at intervals of from four to six weeks until the best result possible is obtained.

Surgical epithelioma of the lip is to be condemned. Radium treatment not only offers a safer procedure, but a far better cosmetic result is obtained. The technique consists in the implantation of small 5 mg. platinum radium needles into the base of the growth from the skin toward the mucous membrane. The needles are placed 0.5 cm. apart and allowed to remain for from four to six hours. One treatment is usually sufficient to remove the primary lesion.

It is usually considered good practice and prophylaxis to radiate the glands of the neck whether palpable or not. This application is made in the following manner: One thousand milligram hours at a distance of 3 cm. is given to each of four areas on either side of the neck. The external treatment is repeated in those cases in which there are small palpable glands. The author believes that the extrinsic metastatic glands should be resected and the resection followed by radiation. In the treatment of these epitheliomata of the lip, the following causes of failure have been noted: diabetes, syphilis, secondary infection, section taken preliminary to treatment, previous treatment with surgery, roentgen ray and radium and hopelessly advanced conditions.

Carcinoma of the tongue should be considered a condition to be treated with radium rather than surgery.

Carcinoma of the tonsil is not an uncommon condition, although the great majority of cases are referred for treatment late in the stage of the disease. Treatment of primary carcinoma of the tonsil yields good curative results, and advanced cases yield worth while palliative results. Implantation of 10 mg. platinum radium needles for a period of from six to eight hours into the growth and surrounding tissues 1 cm. apart is the present treatment.

In early intrinsic carcinoma of the larynx not involving the cartilage, removal from suspension laryngoscopy with implantation of radium needles is advocated as a conservative procedure. Laryngectomy offers the best chance for recovery in the intrinsic cases involving cartilage.

The use of radium as a preoperative and postoperative measure in early cases, and for palliative effect in the advanced cases, is the apparent status of the treatment today.

Sunlight and Health. C. W. SALUBY, M. D., G. P. PUTMAN SONS & Co., New York.

DOCTOR C. W. Saluby graduated from Edinburgh in 1899. For the last twenty-five years he has been devoting his time entirely to the use of sunlight, studying its therapeutic properties both at home and abroad. Much of his time has been spent in Leipzig, observing the results of Rollier, and in Copenhagen at its university. He has gone practically every place in the world where people were using light therapy, has studied under these people, and has put this information in an organized form in this text, *Sunlight and Health*.

The paper here presented contains material abstracted from this book—that is, that part which I considered most important and practical. The contents will be given in the first person, as nearly as possible to conform with the form presented in the text.

CHAPTER II

The results of heliotherapy, as seen by myself, or recorded in Rollier's radiographic and clinical atlas of 1914, or shown by means of illustrations, are unapproached, for certainty, safety, ease, beauty, restoration of function, and happiness during and after treatment. No explanation of them, to be called intelligible or adequate, is offered by any of its practitioners.

In various American laboratories the subject is now being advanced; notably in Columbia University, New York, under Dr. Alfred F. Hess and his fellow workers. They attribute the major part of the action of the sun to the ultraviolet rays, by which, in experimental animals and also in infants, they are able to cure rickets with good speed, ease, and certainty and to increase very markedly the phosphorus in the blood of infants on a constant diet. When I saw this experimental and clinical work in New York last December, the result had already been reached of demonstrating an annual curve, from month to month, of phosphorus in the blood of infants, with a maximum in June and July, and a minimum in March, depending upon the monthly height of the sun in New York. By radiographic study of the bones of infants, it had also been shown that no new cases of rickets occur in New York in June and July, and that maximum number occur in March. Dr. Hess now informs me that the calcium content of the blood follows the same curve as the phosphorus content. Among earlier noted seasonal effects of sunlight, quoted by Hess in his latest paper, are the presence of increased iodine in the thyroid

of cattle from June to November, and the greater resistance of guinea pigs to acetonitrile poisoning in summer.

Hess and his workers have also begun the study of various clothing materials in this connection, and find that they vary in their power of permitting or obstructing the action of light. Specimens of a mercerized cotton, one white and the other black, but otherwise identical, the former allowing light to act and the latter interfering with it, have been examined by me, and I find no difference, due to the black dye, in the spacing between the fibres of the material. But I understand that the Department of Applied Physiology of the Medical Research Council has found, in a series of observations as yet unpublished, that the biological action of light can be graded by temperature.

I think it may be found that the black material produces a higher temperature than the white of the subjacent skin, thus prejudicing those unknown and beneficent chemical reactions which appear to need light and cold for their development.

Many years ago, Sir James Dewar demonstrated the bactericidal action of ultraviolet light upon bacteria AT THE SURFACE of liquid air, but at no deeper level. The action of the light varies according to the temperature factor. The belief grows upon me that the asserted futility of heliotherapy in phthisis is due to the overheating of the patients in the sun. I think that a new chapter will open in the treatment of that disease when practitioners acquaint themselves with the principles and practice of heliotherapy before exposing their patients to the sun.

The power of sunlight and of cod liver oil in rickets has suggested to Professor Harden that the light may cause the skin to produce vitamin A for itself—although no instance of the synthesis of a vitamin by the animal body is known. The most recent work of the Lister Institute shows that light is unable to replace vitamin A completely, but appears to make a small quantity more effective. No one who has seen and touched the typical pigmented skin of a heliotherapeutic patient can doubt that very active chemical processes are there occurring. Perhaps we should regard the skin less as a mere integument than as an organ of internal secretion. The pigmented skin under the sunlight is surely that and we may ask whether it contributes to the making of hemoglobin. I owe also to Sir William Bayliss the information that Dr. H. H. Dale, a member of

his committee, has shown that smooth muscle can be made to contract by ultraviolet ray.

(One is justified on this basis in treating any case of prostatitis or uterine condition or intestinal condition where increased tonicity of the muscular fibers is desired. There is a definite basis for your treatment, and clinically results are obtained.)

Yet another point is illustrated by recent work of Hess which shows that the milk of cows fed on pasture in the sunlight maintains the growth and health of young animals, whereas, the milk of cows fed in shadow and on vitamin free fodder will not maintain life. Our children are thus disadvantaged in winter by the milk from "light starved" cows.

(We do know that the more intense the sun, the more ultraviolet light is radiated. As the sun goes north, we have more hours of daylight, and a greater percentage of ultraviolet light because of the reflected light of the sun. The fish themselves—the schools—seem to go north with the sun. I was reading recently that no light penetrates lower than 400 fathoms, yet I recall that codfish swim as low as 600 fathoms. They must get their light from the surface by refraction.)

CHAPTER IV

The general truth emerges that often, if not always, there is a very marked difference between the action of a drug in the living body and in the test tube. Ehrlich himself had shown that salvarsan acts effectively upon spirilla, not by itself but when, for instance, an extract of liver cells is added. In other words even with the most wonderful and specific and perfectly adapted of drugs, it is necessary that something be done by the body itself for itself. At the moment of the greatest triumphs of artificial therapy the *vis medicatrix naturae* is found to have "been there all the time," and to be indispensable.

When Finsen applied ultraviolet radiation to lupus, he hoped to kill the tubercle bacilli and cure the patient, just like Ehrlich, at a later date, hoping to kill spirochaetes by means of "magic bullets" carrying arsenic. Further inquiry shows that the action of light in reinforcing the *vis medicatrix naturae* is probably far more important than any mere bactericidal power.

Again, waves of still higher pitch, named after Roentgen, are described as killing malignant cells, and certainly do so, but when the clinicians apply in their patients the lessons taught by experimental radiation of, say, detached and living portions of animal tumors in

the laboratory—as now being studied at the Columbia University in New York—they begin to find evidence which, rightly or wrongly suggests to them that the right dose of roentgen rays acts no less by stimulating the tissues of the patient than by depressing the enemy cells. Even here, as in the latest developments of chemotherapy, there may be the indispensable minimum for which we depend upon "ourselves alone" and without which no man can help us.

Or in conclusion, "God helps those who help themselves." We must accept this principle in relation to the action and uses of sunlight, which ever depend upon our VITAL RESPONSE.

CHAPTER V

It is stupid, or, at most, it is merely half and not whole witted, to consider only the toxicity of the guest and not the readiness to be poisoned of the host. The bacteriologist, with one eye looking at his bacteria through the microscope, and the other shut, is the type and the warning of the danger which many of us have not escaped. The other eye, if it were possible as it is not literally, should be looking at the cells of the creature, man or dog or sheep, which the bacteria in the microscopic fields are liable to attack.

CHAPTER VI

The higher pitched notes of the ultraviolet spectrum would be distinctly noxious to our bodies if they were not screened from us by the atmospheric ocean at the bottom of which we live. On the other hand, the lower notes of the ultraviolet, next to the visible violet itself, are unquestionably necessary for our lives, and we suffer when, by any artificial means, we interfere with the selective action of the atmosphere, and exclude the lower as well as the higher ultraviolet notes. Sir Oliver Lodge quoted certain thirty year old experiments made by himself and the late Professor Marshall Wade, which demonstrated the antiseptic action upon pathogenic bacteria of ultraviolet rays of just those wave lengths which are arrested by the addition of coal smoke to the beneficent filter of air above our cities.

CHAPTER VII

The light of day is the source of all life. It is conceivable that, at some remote age, before the solar radiations could penetrate through the earth's then dense atmosphere, terrestrial radiant energy may have served the needs of living things, but in our own time all the ener-

gy that flows through all living bodies, vegetable and animal, including even those of the ocean depths, where no light can penetrate, is the transmuted light of day. It is, of course, possible to have too much of a good thing, and there is, for instance, a disease known as sunstroke, though very few cases so-called are really sunstroke at all, the greater number being more properly called heatstroke, a wholly different thing. Light is the creator of our lives and our stimulant. When the light fails, or even when we shut our eyes, we tend to go to sleep, and the diurnal-nocturnal rotation is beneficent.

The colors of life, which are green and red with their derivatives, are products of the light, and use the light. The cellar grown plant cannot produce chlorophyl, nor the cellar grown child enough hemoglobin.

The skin is sensitive to light. In many animals—and the body of man is certainly an animal—the skin contains many cells in which pigment is formed under the action of light, and in some instances the pigment of these cells can be observed to alter its condition in the presence of light. Thus, has been evolved the eye, wherein the general cutaneous sensibility to light is most superbly specialized and a stimulant effect of that agent is most particularly achieved.

This, however, is not to say that the general cutaneous surface is not affected by light. The phenomenon called sunburn, which we observe more especially in brunettes, who have a larger measure of pigment and pigment forming power in their skin cells, illustrate the sensibility of the skin to light, and so, less beautifully, do the freckles which we observe under the same influence in blondes.

Polar explorers record, that, after prolonged absence of sunlight, all the eyes of their men are blue. The brown pigment can be developed only in the presence of light.

We note in passing that this power of the skin, whilst it doubtless indicates a nervous response to light and enables us to guess how light may thus affect the whole body through the nervous system, also indicates that the blood must be protected from excessive radiations. The response of pigment affords this protection, and thus we have a very simple explanation of the general fact that the density of skin pigmentation in mankind between the poles and the equator is in direct proportion to the intensity of the radiations to which we are exposed.

We have, then, in light, generally speaking, a supreme agent of life and death, with direct and profound influences of various kinds upon all forms of life—not least through the eye upon the brain of man.

But we may be content here to think in terms of ethereal waves, and then we will say that the light which our eyes can see corresponds to something like the middle octave of a piano keyboard, whilst above and below it are radiations none the less real though invisible. Downward through the infrared and heat rays we proceed, the number of vibrations per second becoming less frequent and the wave lengths longer, until, they say, we reach the electrical waves of wireless telegraphy, the wave lengths of which may be half a mile or more. (Our visible octave, we may remember, is an electro magnetic phenomenon according to Clark-Maxwell.) Many of these vibrations are of great therapeutic interest in various forms of electrical treatment which will not here be discussed. In the other directions we pass through the actinic or ultraviolet rays, with their very marked influence upon the chemicals of a photographic plate and upon living things, and it may be, after traversing many octaves, we imagine ourselves arriving at the roentgen rays, so-called soft and hard, with their very marked effects upon living tissues and cells—amongst which we may remark the power, under certain conditions respectively, of killing some malignant cells, of causing malignant growths, and killing of the "germ plasm" and thus causing sterility in persons long exposed to them. The various actions of radium must be remembered in parallelism with those of the roentgen rays.

The Finsen light cures—in chief, at least—by helping the tissues to help themselves, and hence we may guess that light may cure even when it cannot possibly reach the tubercle bacilli in order to exercise any antiseptic action upon them; and thereupon we may begin to use light upon the body generally, for the cure of local conditions, not only superficial, such as lupus, but however deeply seated. And when we do so, we modern sunworshippers are rewarded beyond our most sanguine dreams, as by a deity who answers prayer beyond all that we can ask or think.

The value of natural sunlight upon us children of light, whether as therapeutic in certain forms of disease, such as so-called surgical tuberculosis, or as hygienic and prophylactic during developmental years, and maturity and old age, outweighs all other things as the At-

lantic outweighs the contents of the Olympic's swimming bath.

One cannot expect the skin to respond until it has had a chance. This admirable organ, the natural clothing of the body, which grows continuously throughout life, which has at least four absolutely distinct sets of sensory nerves distributed to it, which is essential in the regulation of the temperature, which is waterproof from without inwards, but allows the excretory sweat to escape freely, which, when unbroken, is microbe proof, and which can readily absorb sunlight—this most beautiful, versatile, and wonderful organ is, for the most part, smothered, blanched and blinded in clothes, and can only gradually be restored to the air and light which are its natural surroundings. Then, and only then, we learn what it is capable of.

Properly aired and lighted, the skin becomes a velvety, supple, copper colored tissue, absolutely immune from anything of the nature of pimples or acne, incapable of being vaccinated, and its little hairs usually show considerable development. When the visitor touches such a skin, in the cool air, he is surprised to find it quite warm. The sun was not shining when I did so first, and the patient was, of course, perfectly nude except for a loin cloth. Evidently plenty of heat was somehow being produced in that little body, with so large a surface to cool by, relatively to its mass. This would seem to be a puzzle, for these patients have, in many instances, never moved a muscle—practically speaking—for months; they have not even had their muscles innervated by faradic current; they have not been massaged. But always the muscles are firm and well developed under the warm skin. "The sun is the best masseur," said Dr. Rollier to me; and one realizes that the stimulant light, playing upon the nude skin in the cool air, induces and maintains that condition of tone in the muscles which, indeed, moves no joints but is yet a form of muscular activity essential for the production of bodily heat and for the proper posture of the bodily parts. Hence we understand how plaster of paris apparatus is here as utterly unknown as the knife. The tone of the muscles, thanks to the nude skin and the reflex response to the light, is enough to keep the recovering young spine, for instance, in proper position, and to form what Rollier calls the "CORSET MUSCULAIRE." One sees very little fat on any of the patients. Their condition is more like that of the trained

athlete, and one's ideas as to the importance of fat in tuberculosis go by the board.

The Greeks believed in stripping the skin, and when we speak of gymnastics we refer to that practice. The idea that a nude person, with pigmented and properly functioning skin, is not clothed soon leaves one at Leysin. Also conventional ideas of modesty receive their death blow. On this point Dr. Rollier writes very interestingly in his *Ecole au Soleil*, where he has to consider the effect of denudation upon the ideas and conduct of his children, and of their parents, and I wish particularly to direct the attention of American readers to this matter. The ideas of decency which, both in the United States and Canada, require that a girl, when bathing, shall wear stockings "or full length"—lest her knees be visible—and which compel a visitor to don a local suit, cumbersome for swimming, because his own "university costume," brought from home, is insufficiently proper, require re-examination in the light of many sciences, abstract and concrete, from ethics to heliotherapy. Our present attitude to the skin is a stupid and dangerous insult to the light of day and to the human body, and like other blasphemies against "COSMOS SIVE DEUS," as Spinoza would have said, is duly visited upon us.

The exposure to light greatly increases the circulation through the now well nourished skin. It causes pigmentation, the result of which is to effect the still more complete absorption of the ultraviolet rays. In any case these rays are very quickly stopped by the skin, as by coal smoke in the air, whilst the red rays pass on.

Processes vastly more subtle than the killing of bacilli by radiations are at work, as we see by the value of the light, generally applied to the skin upon deep seated local infections, and by the curative results of heliotherapy in many affections which no one believes to be of microbie origin.

Also the skin, or rather, the blood abundantly moving through the superficial capillaries, absorbs much of the light and retains it. The physics and the physiology of this matter are still obscure, but the evidence we possess and especially the work of Sonne at the Finsen Medical Light Institute in Copenhagen, is to the effect that the radiant energy must count as part of the energy of the body. There is so much less need to burn up fats or carbohydrates in order to keep the blood warm, if heat is directly passing into it by the skin. Thus, the light is a skin food in one sense of that

term, and saves the digestive mechanism, so that the very moderate dietary of Leysin can be understood. These patients, perhaps in considerable degree, are living directly on light, as green plants do, and are not in so much need of feeding upon the food which green plants have thus made.

And, however it be, the patient loses first his pain and then his fever—a few days and both are done, and thereafter he proceeds to recover. If he arrived with pus in some cavity, it may be withdrawn by puncture, but all “surgery” is ended. “Surgical tuberculosis” is a term which should be regarded as belonging to and ending with the nineteenth century. The knife in these cases is a barbaric and dangerous anachronism. Leysin and other places where heliotherapy is practiced constitute the utter condemnation of all places throughout the world where surgeons operate for tuberculous glands in the neck or “white swellings,” or any other form of tuberculosis. Their very best results, rarely enough attained, are destructive, mutilative, crippling, hideous, compared with the everyday miracle of heliotherapy.

The rewards of the modern sunworshipper are the prevention and cure of what I have here and elsewhere, in previous years, called the “diseases of darkness.” Of these, tuberculosis is the most deadly, by far; the tubercle bacillus is the “captain of the men of death,” as Osler called him or “the prince of the powers of darkness,” as I would call him; the destruction effected by this disease, which should be unknown, is appalling, and our present methods of dealing with it are pitifully inadequate. In a previous volume I have discussed the desolating records of our sanatoria in Great Britain in this respect. But many other diseases belong to the same category. Wholly or in part I include rickets, our general urban anaemia, and many pulmonary infections amongst the diseases of darkness. At Leysin these diseases are unknown. There is no bronchitis, there are no colds in the head, there is no rheumatism. Rollier has perhaps one development of tuberculous meningitis in a year, among all the advanced and ghastly cases that come to him. His records of customary success, during twenty years, include many extreme cases of spinal tuberculosis, with paralyzed limbs, and so forth, of every other part of the body, of course, including the lungs, rickets, many skin diseases, varicose ulcers of the longest standing, wounds of war, nonhealing operative wounds, osteomyelitis,

bed sores, and so forth. How shall we proceed?

Clearly our sociology is all wrong. The shameful death rates, especially during the winter, from our diseases of darkness, the general lowering of vitality and *Joie de Vivre*, the gloomy scenes and the uniform sombre color of the clothes in the streets—all these things lead to a regular hibernal escape from our cities on the part of all who can effect it. The rich or well-to-do go to the Riviera or to Switzerland. On the azure coast they idle, gamble, flirt or what not—but are in the light of day; in the mountains they skate and ski—and are in the light of day; the better of them. Invalids and delicate children go to Bournemouth, or convalescent homes at the seaside or in the country. All who can, escape. In the upshot, the results are deplorable, for the overwhelming majority of the population cannot escape. We have some 10,000 deaths every year in Great Britain from so-called “surgical tuberculosis” alone. These resorts and expedients for the few, the rich or a handful of the poor already stricken, are not how to fight against tuberculosis. We are all wrong from the beginning.

First, the whole series of Dr. Rollier's works should be translated into English. The English translations must be put upon the American market.

Readers in the United States have also lessons to learn. In a country so large and wealthy and progressive, tuberculosis should be already unknown, especially after the evidence from New York. Chicago still burns soft coal and is an abominably dirty city. The tuberculosis death rate has been much reduced in recent years by the policy of segregating the infectious and especially of removing children from infected homes. But there is still much tuberculosis, and there should be none. Philadelphia, the third largest city in the United States, also burns soft coal, and is hatefully dark and dirty.

The great surgical “show” of north America, by general consent, is the world famous clinic of the Mayo Brothers, at Rochester, Minnesota, with its marvelous equipment and organization. All surgeons from Europe crossing the Atlantic go to Rochester. I suggest to North American surgeons that the greatest surgical “show” in Europe is at Leysin, where surgery has been abolished. The knife is not the weapon wherewith *lutter contre la tuberculose*.

Now for Britain. As for the clinical lessons, they are for clinicians. The records, with skiagrams and all, are at their disposal. But the hygienic and sociological lessons are for every reader. The summer goes, and with it the alteration of the clock, which is designed to save daylight. But it is during the winter that the light of the sun is scarcest and most needed. I am satisfied, on the evidence of Canada and Switzerland, that not the very slight cold but the extreme darkness of our urban winters is their fatal factor. We must save sunlight in winter, and this is to be done by the substitution of gas, coke, anthracite, electricity for the burning of soft coal in our cities.

(In summer, we put our clocks an hour ahead to get more sunlight. In winter, we have less sunlight, and we turn our clocks back. If you want sunlight, you want it all the time.)

Generally speaking, ill people should *not* be treated in our cities *until* this reform is instituted. Hospitals in our present cities are an offence against elementary biology and hygiene. The convenience of consultants who attend the Brompton Hospital for Consumptives or the Great Ormond Street Hospital for Sick Children is a secondary consideration. If most patients were treated in the country, in pure air and by heliotherapy they would get along very well with notably few visits from the most illustrious clinicians.

With the rarest exceptions, each of which would be a scandal, reflecting on the past history of the case, operative surgery for tuberculosis should be abandoned. The customary proceeding of opening the lesion, thus making an entry for secondary infection thereafter, is an indefensible barbarism in the light of Ley-sin. Even the elegant and complete removal of infected cervical glands is the removal of the body's natural and precious outposts against infection.

The law against the destruction of daylight by coal smoke and other noxious substances must be amended and strengthened.

The open air school as a device for ill children, here and there, is inadequately valued. We must make our urban air clean, and then plant out our children in it, at school, in such sunlight as we have, and with the minimum of clothing. In the sun and out of the wind—that is where our school children should be. Our

present ideas of fine school buildings are part of the general dementia of our urban civilization.

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(To be Continued)

On the Measurement of X Ray Intensity by Ionization Methods. L. H. CLARK, M. Sc.,
Brit. J. Radiol., 21:21-27, January, 1925.

THE determination of the form of an ionization chamber most suitable for the comparison of x ray beams of various wave lengths, has been a problem of much interest to various investigators. When x rays strike the electrodes or interior walls of an ionization chamber, secondary radiation may be produced by x rays of one wave length but not by those of another, and in consequence the ionization readings for beams of different wave lengths give no reliable estimate of the intensity of the respective beams. To minimize this effect, ionization chambers of aluminum, graphite or wood are frequently used. The readings for beams of different quality are vitiated by secondary radiation produced within the chamber. To obviate this defect, the use of an air gap ionization chamber through which an x ray beam could pass without impinging upon any material of the apparatus was advocated. With such a chamber, it is important to know the effect upon the ionization readings of the radiation scattered from a main beam of soft and hard x rays by the air in the gap. It is this question with which this paper is concerned.

It was decided by the author to measure the ionization which occurred when an x ray beam of constant intensity and quality traversed an air gap between two parallel plate electrodes, the distance between which can be varied. When allowance is made for the change in capacity of the system, with different distances between the plates, any variations in the ionization readings must be due to the quantity of air ionized indirectly by radiations scattered from the main beam. By performing the experiment for a soft and a hard beam of x rays, any observed difference would denote a change in the scattering effect of the air with the wave length of the main x ray beam.

The various experimental procedures and the step by step mathematical data is included by the author in this article.